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CASES
ILLUSTRATIVE OF THE
TREATMENT OF OBSTRUCTIONS

IN
THE URETHRA, &c.

BY THE NEW INSTRUMENT,

THE DILATOR;

WITH
FURTHER DIRECTIONS, TO FACILITATE

ITS
General Adoption:

ALSO,

A CASE OF THE EXTRACTION OF STONE FROM
THE MALE BLADDER WITHOUT CUTTING IT, BY THE DILATOR;

With an Account of

IMPROVEMENTS OF THE METHOD OF

DISSOLVING STONE BY INJECTION,

AND OF

THE COMMON OPERATIONS OF LITHOTOMY.

BY

JAMES ARNOTT,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS IN LONDON.

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Fig. 1.

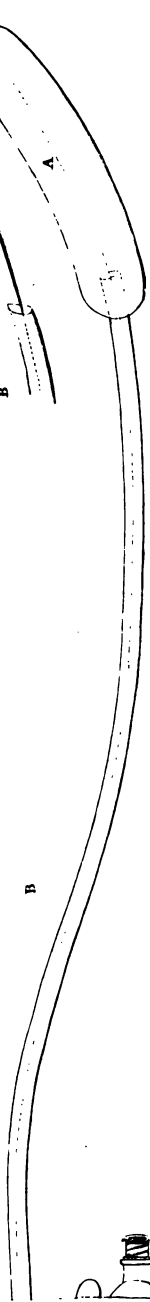


Fig. 2.

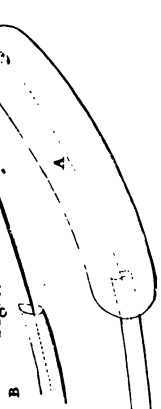


Fig. 3.

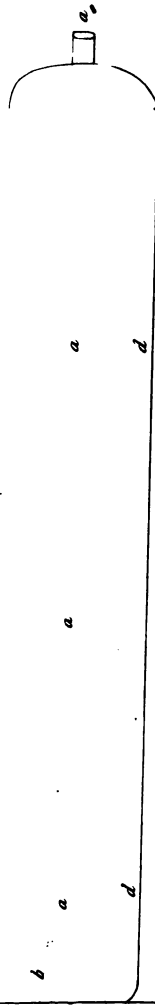


Fig. 4.

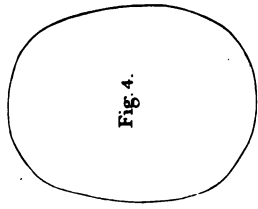


Fig. 5.

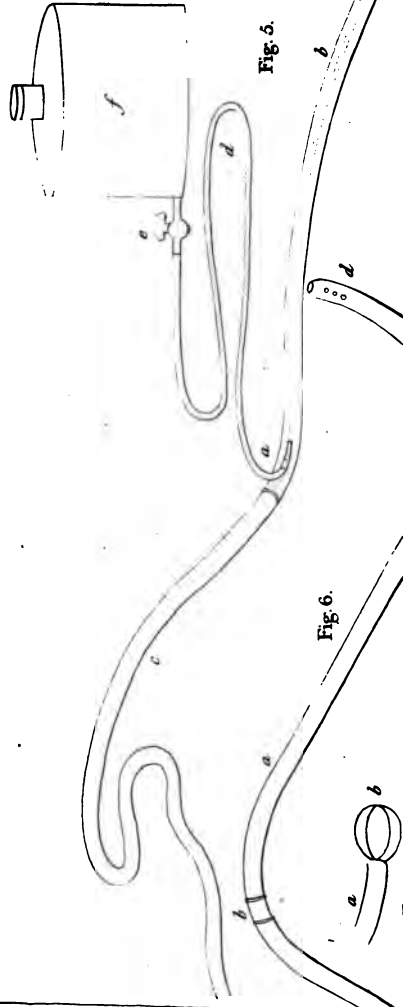


Fig. 6.



## EXPLANATION OF THE PLATE.

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For explanation of *figs.* i. and ii. representing the Urethra Dilator, *see* p. 21.

Fig. iii. is one of the Dilators used in the case detailed at p. 114, in which the Stone, *fig.* iv. was extracted from the bladder, without cutting the prostate gland.

*a, a, a, a,* is a cannula, by which the urine may run off.—*d, d, d,* the distensible tube of silk, lined with gut, surrounding the former.—*b, b, b,* the small cannula, through which the distensible tube is inflated from the bag, *f*; *e,* being a stopcock to retain the air after injection, and *c, c,* a bit of flexible tube connecting the cock to the air tube, so that touching the cock by the syringe or bag may not jar the Dilator in the tender passage. A valve might be substituted for the cock with advantage. As it is important that this Dilator should be perfectly air tight, to prevent the necessity of withdrawing it for any other purpose than the substitution of a larger as the dilatation goes on, the silk tube should be lined with double gut.

Fig. v. is the Double Catheter, for injecting the bladder in cases of irritation of it or contraction, and for the solution of stone: it is exhibited on a reduced scale.—*See* the general description of it, p. 87.

*f,* is the reservoir of the liquid to be injected; *d,* the flexible tube, commencing at the stop-cock *e,* by which

the liquid is conveyed to the inner catheter *a*, which then carries it into the bladder, opening at *a*; *b, b, b*, is the outer catheter, by which the fluid returns with the urine, and is directed to a proper receptacle by the flexible tube *c*, of any desired length. It is important to have the outer catheter of considerable diameter, to diminish the chance of its being obstructed by the tenacious mucus, so commonly secreted in disease of the bladder.

Fig. vi. the Syphon Catheter, for drawing off the urine constantly and completely after the operations of Lithotomy and puncturing, or any wound of the bladder, so as to prevent the urine escaping by the wound.—See the description, p. 102.

Fig. vii. is to give the idea of something made to protrude from the end of a catheter or tube, after its introduction into the bladder, which will act as a button to prevent the tube slipping out, see p. 103. A variety of contrivances are applicable to this purpose.

## NOTE.

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**T**HE superiority of the new instrument, the *dilator*, described in the “Treatise on Strictures,” which I published last year, over the bougies, sounds, and catheters, which had till then been used for the same purpose, was immediately acknowledged; but it was thought by many surgeons, that the difficulty of making the perfect instrument, and the dexterity required in applying it, were so great, that it could not become the common means of treatment. The intention of the following pages is to show that these opinions were groundless. It is true, that when I published the treatise just mentioned, I relied more on the ingenuity of the common instrument-makers, than farther experience has shewn me was reasonable,—and my own familiarity, at the time, with the management of the

instrument, led me to estimate too lightly the difficulties which some surgeons might experience in commencing the practice. I shall shew in the present tract, that the instrument may be very easily made sufficiently perfect for all useful purposes, and very minute and complete directions shall be given for managing it; and, I am sure, that the little additional study which it may require from professional men, to use the instrument dexterously, they will think much more than compensated for, by the increased power of giving relief in the diseases concerned\*.

In the section introductory to the Cases, where I have given a view of the merits of the Dilator as compared with the other means of dilatation, it may be thought by some, that I have entered rather more into the consideration of the nature of stricture, than was necessary in a treatise expressly on the instrument, but I found this requisite to the complete elucidation of the sub-

\* To prevent farther disappointment, until instrument-makers generally, shall be able to provide perfect instruments, I may mention that they may be procured from "Mr. Ironside, N<sup>o</sup> 7, Philpot-Lane, Fenchurch-Street," who has assisted me in the preparation of those which I use.

ject, and no reader interested in the matter will find it tedious. Besides, to surgeons accustomed to think the disease successfully treated, where several months are required for even an imperfect cure, it was important to shew very clearly how the desired end is attainable more safely, and with less pain, by a few applications of the Dilator. It is generally known to the profession, that some of our surgeons in great practice, have removed stricture in the urethra immediately, by thrusting a large instrument forcibly through it, and occasionally with permanent relief; but the terrible accidents that may happen from such attempts not succeeding, are equally well known, and they prove indeed, a decided objection to such rude and hazardous practice. But a dilator may be introduced into a very narrow contraction, and by one effort may widen it to the diameter of the canal, without the possibility, from its manner of action, of tearing the stricture from its attachment, or of piercing the side of the canal; and even without exciting any unpleasant irritation: although it is by no means proper, to run the risk of irritation by such a sudden measure, as, when the object is accom-



plished by four or five applications, with a series of instruments of increasing size, there is little chance of the confinement of the patient being rendered necessary, or of the interruption of his ordinary avocations\*.

The reader must recollect, that although from the purpose of this work, the grand means of curing stricture, viz. dilatation†, is almost exclusively spoken of in it, the several auxiliary remedies for the treatment of particular cases, which were duly noticed in my treatise on the disease, are not to be neglected; but, on the other hand, the surgeon of little practice in this department requires to be warned against the

\* The term Catheter, (from the greek verb καθίημι, to thrust into,) the generic term for the wedge-like instruments—bougies, sounds, &c. points directly to the causes of danger from their employment, viz. the piercing or tearing of the canal, and the irritation from the friction as they work their way through the stricture. The term Dilator, on the other hand, giving the idea of the simple act of dilatation, unaccompanied by any such dangerous progressive motion, points to the nature of the new instrument, and its important additional advantage of dilating to any size, a contraction in the urethra, although the orifice by which it enters be narrow, and thus, in most instances, assuring a permanent cure.

† Dilatation is also the chief remedy for other obstructions of the canal, such as caruncles, swelling of neighbouring glands, or of the corpus spongiosum, &c. which although very frequently confounded with stricture, require a modified treatment.

opposite error of attributing undue importance to the effect of these, and especially of medicaments directly applied to the stricture. The whole *materia medica* was long ago ransacked for this purpose, when the mode of operation of remedies, was very imperfectly understood, (the substances being either incorporated with the other materials of the dilating instrument, or carried down to the stricture on its surface); and remedies of this class extolled as infallible by their original proposers, and afterwards fallen into merited contempt, have again at more distant periods, been obtruded on the public as new, and with similar commendations\*. The application of such medicaments, when they have possessed any influence or activity, has often been productive of harm instead of benefit, and they have only borne the

\* " Il n'est point d'auteur qui n'ait sa composition particulière, et à laquelle il n'attribue des vertus qu'il refuse à toute autre préparation."—*Œuvres Chirurgicales de Desault*, par Bichat, troisième edit. tom. 3 p. 310. From the once erroneously supposed connexion of strictures with the venereal poison, mercury in every form, has been especially applied to them.—Powerful caustic substances, so applied as to destroy the texture of the part and form a slough, are alone sufficient to remove permanent stricture, and cannot consequently be included in the above class.

same relation in remedial value to the accompanying dilatation, that the numberless drugs which used to enter into the composition of ointments for old ulcers, have to the mechanical action of the straps or bandages by which we now so easily cure them. In later and better-instructed times, the only benefit that the sensible surgeon has deemed possible from such applications to stricture, is some reduction of the irritation of the pain caused in great measure by the friction of the bougie; but as it is a peculiar advantage of the Dilator, that it operates without friction and expeditiously, such uncertain auxiliaries will be now little, if at all desirable.

After the detail of some cases of obstruction of the urethra from stricture, treated by the Dilator, selected not as being the most striking instances of happy cure, but as exemplifying the common varieties of the disease, and the consequent modifications of treatment required; histories of other diseases, cured by the same means, are added. Cases of diseased prostate gland, and of stricture of the rectum are detailed, for the cure of which last, the Dilator, from the little irritation excited

by its action, is admirably adapted ; and lastly, one of stone in the bladder, in extracting which, the new instrument was employed to dilate the prostate gland and orifice of the bladder, to save the danger and pain of cutting these. I have taken the opportunity in publishing the latter, of reviewing the subject of calculus generally, and of describing other improvements for the removal of stone, as well by solution as by lithotomy.—I, at one time, intended illustrating by cases the efficacy of the double catheter, (described in p. 87,) in relieving irritation of the bladder in several of the instances where it occurs; but as this would have led me to matters foreign to the leading purpose of the present tract, I have at present deferred entering upon the subject.

38, BEDFORD-SQUARE, }  
*December 1820.*



## Introduction.

**O**F the various plans that have been employed for the removal of stricture of the urethra, that of stretching or dilating it, by an instrument passed through it, has always had the preference as a general remedy, being more safe in its operation than the others, and less painful to the patient. It is true, that the method of destroying stricture by caustic, after being particularly brought into notice about thirty years ago by Mr. John Hunter, for opening a passage through strictures impervious to the bougie, was afterwards for a time extended to strictures of every description, by his relative and successor, Sir Everard Home, and others, because of the quicker and more permanent cures frequently made by it, even in ordinary cases, than could be effected by the instruments of dilatation then known: but caustic has again, as a general remedy, been totally relinquished, from the experienced difficulty of confining its action to the stricture alone, and from the severe pain, irritation, and danger occasioned when this is not accomplished.

As the plan of cure by dilatation has thus always been that chiefly followed, the great question was, how it could be best accomplished. Various instruments had been at different times proposed for this end, and of various merit, but all having many defects. They are very far from realizing the idea of a perfect dilator for the purpose, which evidently should be such as to pass into the stricture without the danger of injuring the urethra, and with the least possible pain, and which shall then dilate the stricture alone, to the extent, and with the force which the surgeon desires, and again shrink to its former bulk, that it may be easily withdrawn.—We shall see presently, however, that this is correctly the description of the new instrument for the purpose, to be treated of in these pages, the *Dilator*.

Before the introduction of this into surgery, the instruments used for the same end were those called bougies, sounds, catheters, &c. They are long probes, tapering or conical in general towards the point, made of various materials, so as to have particular advantages for particular cases. The action of all of them, in dilating, is that of the wedge, and thence they have four radical defects. The first of these which I shall notice, and which proceeds from the necessity of pushing forward

the instrument when it is at, or in, the stricture, to dilate it, is, that the urethra is often pierced by it before or behind the stricture, causing hæmorrhage, false passage, and urinary abscess; or, which is productive of similar effects, the stricture is torn from its situation, and carried forward on the instrument. These misfortunes are particularly liable to occur when much force is employed to dilate, either for the purpose of opening a common stricture very quickly, or when a hard stricture will not yield at all, to milder measures. The second defect is, that, from this progressive motion being necessary to the dilatation, much needless pain and irritation are produced by the friction of the instrument upon the tender parts as it advances. A third great defect of these instruments, from their being unchangeable in dimension, is, that, as the orifice of the urethra is of smaller diameter than the rest of the canal in its healthy condition, it cannot readily, or without much irritation, admit an instrument of sufficient size to dilate a stricture behind, to the level of the canal there; and as stricture not sufficiently dilated, commonly returns on intermitting the process of distension, a permanent cure is thus not obtained. The fourth defect is, that such an unchangeable instrument cannot act equally on the whole of a long stricture, or on several co-existent, at once.



The *dilator*, on the other hand, will be found to be free from all these defects. It consists of a strong, air-tight, membranous tube, as of oiled silk lined with thin gut, about an inch and a half in length, which is introduced into the stricture in its empty or collapsed state, and is then filled to the necessary degree of pressure, with air or water, from a syringe without; and is again emptied before being withdrawn. The dilator while opening the stricture, remains precisely in the same position within it; so that however strongly its action may be required or exerted, even when an old stricture is completely opened by it at one application, it cannot possibly, like bougies, either pierce the urethra, or tear it. As it is introduced in its shrunk or collapsed state, no painful or injurious friction is then occasioned. And, from its being changeable in dimensions, it will enter an urethra with the narrowest orifice, and still dilate a contraction in any part, to the natural size, or beyond that, if necessary, without stretching, like the bougie, the whole canal anterior it. For the same reason the dilator acts equally on the whole of a long stricture, or on several strictures at once.

These advantages of the new instrument over the old means for dilatation, are such, that if it possessed but one of them, being at the same time free from a single defect, or objection, it would be of great importance.

In the more minute comparative examination of the distinct instruments for dilatation, which I shall make the subject of the remaining part of this Introduction, the object will be, while rendering their respective merits more intelligible to those who have had little acquaintance with this part of surgery, than the above tabular view is fitted to do, chiefly to establish certain principles regarding the treatment of stricture generally and the action of the dilator, necessary to explain the reasons of some of the practical rules for the application of this instrument, that will be given in another part of the work.

The first great defect of the bougie, (which I shall employ as the generic term for all the instruments that dilate as wedges), from its requiring to be pushed forward in the canal to dilate, is the occasional piercing of the urethra directly, or the tearing of the stricture from its attachments.

There have been two distinct modes of using the bougie, characterized as the sudden and the gradual dilatation of strictures. Some surgeons force a large bougie through a narrow stricture at once, while others begin with a small bougie, and use very little force, being contented often, if there is a perceptible dilatation after several applications. The urethra may be pierced even in the gradual method of dilating, but this

much more frequently occurs in the sudden attempt; and in this last alone, can the tearing of the stricture from the urethra happen.

The method of dilating stricture by forcibly thrusting a bougie through it, has always been more or less practised, and at present it is very commonly employed by some of the first surgeons in Europe. They prefer it to the slower or gradual method, chiefly for the following reasons. The relief from it, when it succeeds, is immediate; whereas the cure by the latter method requires, in general, a period of two or three months, or even more, according to the obduracy and number of the strictures in the canal, and it is a process so troublesome and tedious, that the patient often losing hope from the slowness of the relief, for a time abandons the treatment. The irritation of the stricture, and neighbouring parts, is often greatly increased from the frequent passing of the bougie, and induces, directly or indirectly, some dangerous or obstinate disease in these parts, as retention of urine, its extravasation from breaches in the urethra behind the stricture, diseased prostate gland, &c. And many cases of stricture occur, of a texture so firm and hard, from long continuance, or repeated attacks of inflammation, (of which this slow treatment is itself often the occasion), that gentle dilatation by the bougie may be found inadequate to affect

them, consequently greater force must be applied, or other remedies, as caustic or cutting, must be resorted to.

It may at first appear extraordinary, that any degree of contraction of so small a canal as the urethra, should require so long a period to be dilated, even by the mildest and slowest means of operation ; but several causes conspire to this, of which the following is one of the principal. The stricture is either elastic, or endowed with a power of muscular contractility ; if little dilatation be made, this elasticity or contractility will be little, or, perhaps, not at all weakened, and the contraction recurring when the instrument is withdrawn, it may not be till after several such applications, that an instrument of larger size can be introduced. The spring has only been bent, or at most its strength has been but slightly subdued. To destroy permanently the power of recontraction, much greater force is requisite. Besides, the stricture, by the forcible use of the bougie, may be slightly ruptured in many cases, as well as dilated, and the ulceration thence ensuing, will still farther tend to make the enlargement of the canal permanent.

Those surgeons who prefer the slow and more cautious manner of applying the bougie, which is still the common method of using it, are influenced by the great danger there exists of

tearing or piercing the urethra, by attempting to force an instrument quickly through a stricture. For this is always of harder and firmer consistence than the adjoining natural urethra in which it is situated, which is indeed a very delicate membranous texture; and occasionally, instead of being a mere contraction of the canal, as if a bit of packthread tightened it, the stricture occupies perhaps half an inch, or more, of its length. It is evident, then, that if the point of an instrument be lodged within a very hard or long stricture, upon pushing it on, this will probably not be dilated, but be torn from its attachments. Again, of whatever description the stricture may be, if the point of the instrument, instead of being inserted into its orifice, or kept in the line of the canal, should be directed to the angle between its anterior surface and the urethra, upon force being applied, it will certainly rupture this, and be plunged into the neighbouring solid parts. There is great hazard, likewise, of piercing the urethra, from the point of the instrument, after it has passed through the stricture, which it is the surgeon's object to dilate, being opposed farther on in the canal, by being improperly directed, or by another stricture, enlargement of the prostate, pitting, or irregularity of the urethra, &c.; for the surgeon, in attempting to force

a stricture, cannot always discern whether the whole of the opposition felt proceeds exclusively from it, or partly from a further obstruction. It is under these circumstances that the urethra may be pierced, during the gentle use of the bougie, although, from the mischief being then of gradual production, and consequently attended with no alarming circumstance, as hæmorrhage, to excite suspicion, it is not always ascertained during the life of the patient.

These accidents of tearing and piercing the urethra, are not of uncommon occurrence; and this, not only amongst the surgeons who advocate the more forcible manner of using the bougie, but amongst those also who follow the opposite plan, who, occasionally betrayed by their impatience at the little progress they make by milder measures, are led to act in a directly contrary manner to their established opinions. The immediate effect of this sort of injury to the urethra, when occasioned by the forcible thrusting of the bougie, is profuse hæmorrhage, much inflammation about the part, and local and general irritation; and from the insinuation of urine into the breach of the urethra, urinary abscess and fistula in the perinæum may be produced. But one of the most harrassing consequences, and which may be caused by the gentlest employment of the bougie, is the new or false passage formed by

the side of the proper one, into which the instrument almost invariably passes, in any future attempt at introducing it into the bladder ; and the original disease being thus left to increase, the patient remains in danger.\*

All these hazards are completely removed by using the dilator to open the canal ; which, whether it be made to dilate quickly, or more gradually, remains during the process exactly in the same position in the canal, and can only act on the stricture. Many strictures will yield speedily to a gentle elastic continued pressure ; and to produce such was the common intention with which I at first employed the dilator ; but, for some time past, unless certain circumstances, to be afterwards mentioned, prescribe a contrary course, I have preferred making instantaneous and considerable dilation of the stricture. I was led to this change from finding that many strictures yielded almost immediately to what I had esteemed, from the little uneasiness the patient experienced, but gentle distension,

\* Mr. Hunter, in his Treatise on the Venereal Disease, speaks of the practice of " forcing a common sized bougie through a stricture that only allowed a small one to pass," as a hazardous practice which he had " never tried." I was some time ago consulted by an elderly gentleman, into whose rectum a sound had been plunged in an attempt to force a stricture, by a surgeon of eminence, and one of Mr. Hunter's cotemporaries ; but his constitution being good, the opening into the gut closed.

which, in reality, however, must have been very powerful.

I possess, therefore, with the dilator, all the advantages of the quick method of dilating by the bougie, without the danger of rupturing the canal, or the pain and consequent irritation from the friction, and dragging of the stricture, that accompany the most successful instances of forcing. — To a certain class of strictures, those, viz. which, from long continuance, or the unprofitable employment of remedies, have become extremely callous and unyielding, dilatation by the new instrument is almost the only kind applicable; for the mild action of the bougie can scarcely affect them, and the attempt to force such strictures can seldom fail of rupturing the contiguous urethra; while caustic, at least if applied as it has hitherto been, will, in many cases, burn a passage through the side of the urethra before it has penetrated the harder stricture. In one of the cases narrated after this Introduction, the patient had had two such strictures for a period of four years; and although, from their insensibility, it was found admissible to use considerable violence in introducing instruments, still, in all that period, no dilatation was effected. Both were opened to the full size by three strong applications of the dilator.

In now speaking of the second defect of the



bougie, the friction as it advances, we have to remark, that the greater proportion of strictures are very far from being of a callous description; some, indeed, are so morbidly sensible, that the patient can scarcely endure an instrument of any size to pass through them: and for such the bougie is, from this friction, as imperfect a remedy as for the hard strictures, treated of above. From comparing the effects of the bougie and the dilator, in similar cases, I am convinced that, even in strictures of the ordinary degree of sensibility, treated by the bougie, more than half of the pain at the time, and of the consequent irritation, proceed from this friction; which therefore not only causes unnecessary suffering to the patient, but protracts the cure, by occasioning inflammation, &c., and consequent intermissions of the treatment. In stating the advantages of quick over slow dilatation, the immediate recontraction of the stricture after the latter on withdrawing the instrument, from the elasticity or muscular contractility not having been much weakened, was mentioned as a cause of the protraction of the cure, for months; the effects of the irritation from the friction produced by this instrument, constitute the remaining causes. Although, merely touching the stricture repeatedly with a bougie, will often reduce its sensibility, (and certain surgeons, who regard

the disease as but a permanent spasm of the part kept up by irritation, govern their practice in many cases by this principle,) any stronger action often produces irritation, which has a directly contrary tendency to the dilatation. Irritation originally induced the disease; and, whatever the nature of the stricture may be, it invariably tends to augment it; so that, in the two or three days which must usually intervene between the several applications, the stricture is occasionally more contracted from the irritation produced than it was enlarged by the instrument. A dilator, even so applied as to produce no more dilatation each time than the bougie, would still, from the distension produced being unattended with friction, remove the stricture perhaps in half the time the bougie requires, and with half the suffering to the patient. Stretching it suddenly, as we have said, destroys its contractility, so that a trifling increase of irritation produces little inconveniency.

Another disadvantage attending this irritation, and which has not been overlooked by surgeons, is the hardening of the stricture from inflammation, rendering it more difficult to be removed. A stricture being often originally but a spasmodic contraction of the fibres of the canal, or a wrong action of these fibres, is at first easily removeable, and often continued elastic

distension by one application of the dilator will do it, the compressed air expanding to follow the yielding stricture, but when continued irritation has changed the structure of the part the cure is more difficult.

The next grand defect of the bougie arising from its incapability of being enlarged and diminished while within the urethra is, that, when two or more strictures exist together in the canal, the bougie can seldom act efficiently but on one at a time, which exceedingly protracts the cure; and if a stricture happens to occupy some extent of the canal, unless it be gradually narrower, the nearer it approaches the bladder, the pressure made by the bougie must, for a long time at least, be nearly confined to its anterior extremity. Hence it arises that such cases have so often resisted the bougie, while the employment of caustic in them, applied as it has generally been to the anterior surface of the stricture with the purpose of gradually working its way through, has often done great mischief by making a new passage. The dilator supplies the desideratum; but as the long strictures often differ considerably in structure from the short and ordinary species, they require the method of treatment by the dilator to be likewise different.

The common short, thread, stricture, is a mere contraction or approximation of the sides

of the canal, or very nearly so, and requires nothing but simple dilatation for its removal. The long ribbon stricture is, most probably, often chiefly constituted by a thickening of the coats of the urethra from deposition of new matter, and, that it may be removed, it is necessary to get rid of such matter. Pressure causes its absorption ; but pressure, to have this effect, must be continued. In dilating strictures, surgeons have never made any difference in treatment between the long and short species, either applying dilatation but for a few minutes at a time, as is the general practice in this country, or keeping the catheter constantly in the urethra, as is customary in France. It is difficult to assign any other reason for this contrary practice of the two countries, than that English surgeons depend upon simple dilatation, as a remedy, while the French have other ends, as ulceration, in view.

Each plan, I conceive, is best adapted to its particular case ; the momentary dilatation, to the short stricture, the continued, generally, to that occupying some extent of the canal ; but as there was, till lately, no perfect means of distinguishing these varieties of stricture in practice, the plan of short dilatation, as being generally the appropriate kind, appears to have been the best, producing equal advantage with

the other, without the increased trouble and irritation. The length of strictures, if they are as yet passable, may be easily ascertained by examining them with a modification of the dilator. The distance of the farther extremity from the orifice of the urethra, which is all that is required to be known for this purpose, is discovered by passing the instrument beyond the stricture, then distending it, and retracting it till it is opposed by the obstruction. In conducting the cure of long strictures from thickening of the urethra, the dilator may be used repeatedly, keeping up a gentle pressure for a considerable time each application; or if the patient's mode of life or circumstances will permit it, the canal may be so distended by one sufficiently continued application of the elastic dilator, as to admit a flexible catheter of the largest size, which will remain in the urethra, to continue the distension till the obstructing matter is absorbed. When such a stricture occurs near the orifice of the urethra, the introduction of the catheter is not requisite, as a very short tube, properly fixed by tapes to the penis, will preserve the dilatation without incommoding the patient. When the stricture is in this situation, caustic may be easily and correctly applied to its inside or channel, in the manner which I have recommended in my Treatise on Stricture,

and, by exciting ulceration, will often expedite the cure.

The fourth great defect, a consequence of the unchangeable dimensions, of the bougie, is its incapability of completely dilating the stricture, that is, of reducing it to a level, or beyond a level, with the adjoining urethra. For, by casts taken of the urethra, it has been ascertained that it is by no means a regularly cylindrical canal in its distended state, but that its orifice is much smaller than any other part, and that there are several variations of diameter in its course, especially at the bulb, where the canal is one-half larger than elsewhere. Now, unless a real stricture be completely dilated, it will generally return; and hence it happens, that dilatation by the bougie, or wedge-like instruments, so seldom effects a permanent or radical cure." The orifice, which being surrounded by a firm band, will scarcely admit of dilatation, has been frequently cut to permit the passage of large instruments; but even then, they can seldom be used of sufficient size, on account of the great irritation excited by their passage down the canal. They have accordingly been in general, long given up, and most surgeons have been content merely to palliate symptoms by the employment of such sized bougies, as can safely be

introduced\*. By this means, although the more violent and sudden effects of stricture are prevented, the long continued irritation of the urethra, which is the almost constant attendant of this disease, seldom leaves the general constitution, or the condition of the neighbouring organs, unimpaired. When we find that a very trifling irritation of this canal is sufficient to induce a violent paroxysm of fever, we can easily account for the emaciation, irritability, and general derangement of the functions in patients who have long complained of stricture. They are constantly liable to sudden retention of urine; the functions of generation may be deranged; and the bladder and prostate gland, disease of which so often embitters the latter period of life, seldom escape injury.—If any strictures be found which cannot be permanently removed by the dilator, although it can be introduced through the narrowest orifice, and dilate to any extent, without exciting injurious irritation, yet all at least will be done by it, which dilatation in any way is capable of effecting.

\* The impropriety of using large instruments, on this account, was shewn, fifty years ago, in the writings of Sharp and Bromfield. I had occasion lately to see a patient who had been confined to bed for two or three weeks, in consequence of a violent irritation of the urethra and bladder, occasioned by an attempt to pass a very large sound into the bladder.

There are other minor advantages possessed by the dilator over the bougie, which it is unnecessary here to enumerate. I shall however consider one of them at present, because it may furnish the surgeon with a means of relieving some cases of impassable obstruction in the urethra, which formerly, could only be removed by measures of considerable hazard. When two or more strictures exist near each other in the canal, it occasionally happens that the openings through them are not in the same line, so that an instrument which has passed through the first, is directed by it away from the opening of the second, and often cannot proceed. Something of the same kind frequently happens in long strictures, which are tortuous, and which indeed can scarcely be distinguished from the other. If an attempt be made to dilate such strictures, by pushing the instrument forward, there is great risk of piercing the side of the canal, and if caustic be applied to a long stricture, we have already seen the danger of its deviating from the desired course. The dilator, however, as it can open the first short stricture, or the beginning of a long one, without the possibility of its doing injury further on, easily opens its way through all when it has once entered. A case illustrative of this will be given in a following section.





**EXPLANATION OF THE PLATE, FIGURES 1  
AND 2, APPERTAINING TO THE URETHRA  
DILATOR.**

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IN explaining these figures, I shall give a minute detail of the manner of constructing the instrument, sufficient to enable any dexterous workman to make it, and I shall add some remarks on the manner of using it, which, with the contents of last section, will constitute a complete code of directions for the surgeon.

Fig. 1 represents, in its distended state, a common urethra dilator of size No. 14. The part which acts upon the stricture is the short tube of strong silk, A, when distended. This is lined with thin gut, to make it air-tight, and covered with the same, or with varnish, to make it smooth for passing down. One end of it is tied upon the extremity of the directing wire C, and the other upon the extremity of the tube, or cannula, B. The wire C, which runs through,

and projects beyond the cannula B, serves to conduct the dilating tube in its collapsed state into the stricture, and by the cannula, the distending fluid, air or water, is injected from the syringe D. The stop cock E, screwed into the outer end of the cannula, at F, retains this injected fluid.

Fig. 2 represents the skeleton of part of the dilator, without the distensible tube, that its construction may be better understood.

The cannula B may be of the common elastic catheter tube, or of tin, which is flexible, or of silver. To its outer end at F, is fixed, by cement, a small connecting piece of brass, to receive the corresponding screw end of the stop cock E, or of the syringe D when only momentary distension is made, and the cock therefore is not required. At its other end (fig. 2,) it is represented as roughened, that the silk and gut tube may be more securely attached to it.

The wire C, (which is represented by the dotted line in fig. 1,) is of silver, prepared so as to be elastic, as small as the necessary degree of strength will permit, and sufficiently long to project from both ends of the cannula ; from the inner end, as much as the length of the distensible tube is required to be, and about one-fourth of an inch at the outer end, where it has a knob on it, or hook, to prevent the possibility of its slipping from the tube, and being left in the

urethra. At its point (fig. 2,) there are two knobs or risings, between which the silk is tied on ; one constitutes the point of the finished instrument, and is one-tenth of an inch in thickness, that it may pass easily; the other, a quarter of an inch distant from it, is merely large enough to prevent the tying from slipping back upon the wire. The wire is freely moveable to and fro in the conducting tube, for several reasons, such as to facilitate the tying on of the silk, so as not to leave it twisted, and that the silk tube be neither too slack nor too tight on the wire. That the surgeon may be able, however, to direct the point of the wire to the opening of the stricture, the whole should receive the double or S curve, natural to the urethra, as is shewn in the plate.

In particular cases, instead of the wire, some other substance, as whalebone, may be substituted with advantage, but the surgeon must be aware of the possibility of a very flexible point being bent back on itself, or doubled in the canal, in which state, should the instrument be distended, considerable injury might ensue.

The syringe D is a brass forcing syringe, three and a half inches in length, and a full half-inch internal diameter. When it is meant to continue the distension for some time, the small brass stop-cock E, fig. 1, must be attached to the tube ; but in general, in treating stric-

ture of the urethra, this is unnecessary. Besides the saving in the expence, when the stop-cock is dispensed with, the water can then be more quickly injected, which is a great advantage, as it makes a moderate leaking of the distensible tube of no importance.

For ordinary cases of stricture, the distensible tube may be constructed of strong silk ribbon, with the edges sewed together, and having its seam turned inwards, lined and covered with thin gut. Such a tube will in every instance be found of sufficient strength to bear the requisite degree of pressure. The greatest pressure of the thumb upon the piston of such a syringe as has been described, will rarely rupture it, and this force is more than the hardest stricture can for a moment resist. When little bulk in the dilator is desirable, as in the very beginning of the treatment, the thinnest oiled silk, lined with a gut, will be preferable; but as this will often give way to great pressure, it is proper previously to ascertain how much it can resist, and to point this out by a mark or check on the piston rod of the syringe. Besides the loss of the distensible tube from such an occurrence, there is a chance of injury to the urethra from the lining gut then protruding forcibly through the breach in the silk. In some very narrow strictures I have even used at first, merely a bit of single or double gut with-

out a covering of silk at all ; but besides the want of strength, in such a tube, to bear any useful degree of pressure for hard strictures, it soon enlarges from the moisture, and is thus apt to distend the sound as well as the contracted parts of the canal. It is possible that some kinds of gut may be naturally, or by preparation, sufficiently strong to bear momentary useful pressure, yet this is not particularly desirable, for although such a tube might be simpler, it would not endure, by any means, so long as that of silk ; and a silk tube dilator, of moderate diameter, when collapsed, is as small as the smallest point that can safely be introduced through a stricture. The dimensions of the silk tube will vary of course according to the circumstances of the case in which it is to be employed. If several strictures are to be dilated at the same time, and if they are situated in the curved part of the urethra, the distensible tube must be long, and corresponding to this curve ; but, on ordinary occasions, it should seldom exceed two inches in length, and then the curve is unnecessary. The regulation of the diameter of the dilator will be afterwards noticed.

The gut which I have preferred for these purposes, is that of the cat. When prepared, by stripping off the outer fleshy coat and inner villous one, it is exceedingly thin, and yet sufficiently strong. That the gut may be completely supported by

the silk tube when distended, it must be at least of equal dimensions with it ; and it is well to insure this by choosing it of larger size. When the stricture will admit an instrument of considerable size, as in stricture of the rectum, in order to preserve the dilator long air-tight the lining gut may be double. When the silk has a covering of gut, which, on several accounts, answers better than varnishing it, this outer gut must be pierced in several parts, in order that any of the fluid escaping from the inner gut may have free escape into the urethra, and not distend the covering beyond the silk.

The only part of the preparation of the dilator requiring nicety of execution, is the attachment of the distensible tube to the conducting tube and wire, which must be at once very neat and very secure. The silk tube and lining gut should be tied on together, the artist taking care that the wire be kept exactly in the axis of the tube, or that the wrinkles or folds at the extremity be equal all round. The tyings may be made conical by notching the extremity of the silk after two or three turns of the small strong waxed silk thread have been made round it, and by then continuing the thread completely over it. The tyings should then be smoothed by a coating of bougie wax, and if unvarnished silk has been used, the operation is completed by covering both the silk and the tyings with a

bit of gut. The secure attachment of the distensible tube to the cannula and wire is a matter of great importance; for, should the silk become detached in the canal beyond the stricture, it might happen, that the combined action of the urethra and the flow of urine would not be able to expel it, until the stricture were fully dilated; it behoves, therefore, both the instrument-maker, and the surgeon, to be careful that there exist no such hazard. The accident would prove great negligence.

The gut must be wet during the preparation of the instrument, and at each time of using it, to prevent its cracking, or the escape of the air under the dry and shrivelled tyings. After use, the water must be as much extracted as possible, and then it should be inflated and put aside to dry. This prevents the rotting of the gut. When the distensible tube consists of unvarnished silk lined and covered by gut, it is more easily both dried and moistened, than when varnished silk is used.

After these very minute directions, equally necessary to be attended to by the surgeon and instrument-maker, I trust that the difficulty of preparing the dilator, and keeping it in order, will not henceforth annoy surgeons in using it. —And as two or three sizes of the dilator are sufficient for the treatment of every common case of urethral stricture, this apparatus



will really be found less troublesome and expensive than the other instruments for dilating at present used.

The skeleton of the instrument, consisting of the cannula and wire, are exceedingly durable ; one syringe serves many ; and the distensible tube may be easily renewed, or a slight imperfection in it remedied, by any neat-handed person, or by the surgeon himself, when he has time ; to whom besides, such an office is not without use, as an exercise of that neatness of manual operation so necessary to the correct practice of his profession\*.

\* To prevent disappointment, the surgeon, in ordering an instrument from the maker, should specify the minutest particulars regarding its desired construction ; as whether it should have a stop-cock, the kind of cannula, the dimensions, and kind of the distensible tube, whether some spare distensible tubes should accompany it, &c. I mention these things, because I have understood that orders have been often sent for a dilator without particularising any thing ;—and the instrument sent, frequently, not being the appropriate one, disappointment has followed.

*Description of the Manner of applying the Dilator.*

ONE difficulty which surgeons may experience in commencing the practice of the dilator, is to know when they have got the distensible tube exactly in the stricture. By careful previous measurement the object may in general be secured, but where there is doubt, the end of the conducting tube may be enlarged, so as to form a kind of button ; and when this is obstructed in passing on, by the stricture, the silk tube must be within it. Or again, a short distensible tube without such a button at its outer extremity, may be passed beyond the stricture, then filled and retracted till this impede it ; allowing then the fluid to escape, and withdrawing the instrument half an inch farther, it will be within the stricture.

After thus placing the distensible tube accurately, the syringe has now to be applied, and the patient may keep the tube steadily in the proper position, by resting the wrist of the hand employed, upon his groin : he must retain it so, if the pressure from the injected fluid is intended to continue for some time.

Continued gradual pressure is best made by injecting air, the elasticity of which continues

the dilatation as the stricture gives way, and yields to any momentary violent spasm of the parts; and more is afterwards injected, or part allowed to escape by the cock, according to the patient's sensations. If the dilatation is intended to be sudden and momentary, then the injection of water will, on several accounts, be preferable to air.

Regarding the rapidity and degree of distension to be made on each application of the instrument, the length of interval between the several applications, the general management of the patient in these intervals, and the extent to which the dilatation should be finally carried, the following are the general rules which my practice enables me to give, and, with the subjoined cases, they will be of use in guiding the judgment of the practitioner to the proper treatment of particular cases.

It has been already stated, that, in the greater number of the varieties of stricture, momentary and considerable distension by the dilator is the best method of treatment; it is the quickest, and, as has been before explained, it is the most effectual. It is also productive of less uneasiness to the patient than any other method of treatment whatever. The distension is exclusively confined to the hard, and often nearly insensible contraction, and the short stay of the instrument in the canal, occasions no painful spasm or

irritation from the ineffectual attempts of the urethra to expel the foreign body.

It might answer in some cases to dilate the stricture at once from a very narrow state to the full size of the urethra, but to avoid possible irritation and its consequences, it is the better plan to accomplish this by several applications. For this purpose I employ a gradation of sizes in the distensible tube of the dilator, which appears preferable to using one large size throughout; for granting that this last could, in its collapsed state, be passed through a very narrow stricture, if not completely filled afterwards, it would be impossible to determine to what degree the stricture is stretched by it.

When great irritability of the urethra exists, or there is tendency to swelling of the testicles, abscess in the perinæum, &c., then along with, or subsequent to other proper measures for the removal of these affections, a gradation of dilators with still smaller differences may be adopted for the removal of the stricture. — Gradual continued dilatation is generally the best plan, when the stricture is of the long species. And when any doubt exists about the nature of the obstruction, as whether it be a real permanent stricture of the urethra, or only a temporary impediment, as from a spasm or inflammation, on the first application of the instrument, at

least, the milder pressure is preferable. In conducting the treatment in this manner, (as also when stronger distension is made,) a variety of size in the dilator, though not absolutely necessary, is more adviseable than using but one size throughout. For, if a large size is introduced through a narrow stricture, the greater part, or the whole of the uneasiness experienced by the patient on distending it, will often proceed, not from the dilatation of the stricture, but from the pressure of the distensible tube on the inflamed or irritable urethra behind it.

The common trifling effects of the introduction of other instruments into the urethra, as scalding pain on urining, increase of the gleety discharge, slight febrile symptoms, &c., may of course arise from the more effectual operation of the dilator. If rapid dilatation, to considerable extent, be made by it, the instrument may be extracted soiled with blood, and a few drops may ooze from the urethra afterwards, which will prove it to have acted effectually on the stricture. However, as the stricture exclusively, is acted upon by the dilator, and is generally less vascular than the contiguous urethra, I have never observed from the most rapid distension effected by it, hæmorrhage to the same extent as is often produced by the bougie. In this latter case, as the blood comes not from the

vessels of the stricture alone, but chiefly from the violence done to the neighbouring urethra, when profuse it is alarming, as indicating that violence has been done.

The general rule in the treatment of strictures by dilatation, not to re-apply the instrument producing it, before the irritation, often arising from the preceding application, has nearly or quite subsided, is the best to guide us in the use of the dilator. Every alternate, or every third day, will usually be the least admissible interval, when the sudden dilatation is produced by the dilator.—The general management of the patient's regimen in these intervals is, likewise, the same as during the treatment by other means. He must avoid every thing that would tend to increase the irritation of the urethra, such as much exercise, sudden exposure to cold, irregularity of diet, &c.

A dilator, measuring in its distended state, one-third of an inch, is of about the natural average diameter of the urethra, and if the stricture has been *quickly* distended to this extent, it will probably, in most cases, be permanently so distended. At any rate I think, that, as a general rule, the stricture need not be dilated farther, till, upon trial, this degree of dilatation is found insufficient. It has long been found of advantage, to leave off the use

of the bougie gradually, after the greatest dilatation it is capable of producing has been accomplished; and the same practice may be advantageously adopted with the dilator; or, as the patient might not be able to apply the dilator properly himself, or to continue so long under the surgeon's care, he may be instructed to use in its place a large bougie for the same period.

## CASES.

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### CASE I\*.

A. B. a gentleman of about fifty years of age, spare habit, and sallow complexion, is affected with difficulty in voiding his urine, frequently requiring to strain for some time before it flows, and the stream is often checked before the bladder is empty. He requires to urinate every two or three hours. The stream is very small, and often divided. Scalding pain is experienced in the urethra on urinating, and a gleet discharge oozes from it.

These symptoms he has had, more or less, during the last four years, without being able to assign any cause. Soon after their commence-

\* This was one of the first cases of stricture treated by the dilator, and before I commenced the general employment of the sudden dilatation; accordingly, although the effect of the treatment here pursued forms a very favourable contrast to that where the bougie is used, it will still appear inferior, in several respects, to that from the quicker mode employed in several of the subsequent instances related. Although I shall not, in arranging these cases, attend regularly to the order of time in which they occurred, I have done so in this instance for the sake of many little circumstances illustrative of the use of the dilator, which, when they were new to me, I noted, but of which I afterwards took no account.



ment a stricture of the urethra was discovered. The bougie was employed in the common way to dilate this, but as the relief from it was exceeding slow, he became impatient, and left his surgeon when only a middle-sized instrument could be passed to the bladder. He found the necessity of regularly passing the instrument afterwards every week, or fortnight, to prevent the recurrence of the more urgent symptoms, but being frequently obliged, by professional avocations, to travel from home, he was exposed from irregularities of diet, and inclemencies of season, to temporary increase of difficulty of urining, occasionally amounting to severe strangury. Of late he observed that the stricture was again permanently increasing, and it has returned at last to such an extent, that he cannot pass through it the smallest bougie, and every attempt at this, violently increases the irritation of the canal.

I passed a large bougie down to the stricture to ascertain precisely its depth in the canal, which appears to be six inches and a half from the orifice. After failing to pass a small bougie through the stricture in the common way, I passed down to it a wide elastic cannula, and by this conducted the smallest elastic bougie to it\*, which, after some trials, went onwards to

\* The advantages of this plan I explained in page 120 of my Treatise on this disease. I again strongly recommend it in cases

the bladder. My object being rather to accustom the irritable stricture to the presence of instruments than to dilate it, the bougie I used was almost cylindrical.

3d, 5th, and 7th days of the cure. I did little else on these days than repeat the operation of the first day, as the parts, though less irritable, were yet in such a state as would render much dilatation inadmissible.

10th day. A No. 5 bougie \* passed by means of the tube through the stricture, and after it had remained stretching it for some time I introduced a No. 9 dilator in its stead. With it I now gradually made as much pressure by injecting air as the patient could easily bear. After the dilatation had continued for about ten minutes, the air was allowed to escape ; and the dilator and elastic tube were withdrawn. The patient immediately afterwards had occasion to make water, when the stream, although productive of some scalding pain, was observed to be considerably enlarged in consequence of the dilatation.

12th day. The stream of urine, though larger

of very narrow stricture, or where it is impassable to other measures.

\* That is five-fortieths of an inch diameter, according to the scale described for adjusting the sizes of bougies in my former work on stricture, page 176.

than it was before the last application of instruments, is not so full as immediately after it. I used the same dilator to-day, and, in every respect, as on the former occasion. The last time the instrument was used the pain increased according to its continuance in the canal, but to-day it diminished in the same proportion. The dilator was introduced to-day without the elastic tube through which the small bougies had been hitherto passed, and, according to the patient's statement, with as little uneasiness as the bougies ever caused which he himself had employed.

13th day. So little uneasiness followed the last introduction of the instrument, that the patient, for the sake of expedition, wished a repetition of the process to-day. I introduced the same dilator, and inflated it to the full extent by a continued motion of the piston of the syringe. The dilatation appears to have been previously carried to the full extent of this instrument, for the operation of to-day was scarcely productive of any pain.

15th day. I substituted a No. 12 dilator for that hitherto used. It passed very easily into the stricture; I inflated it, as on the former occasions, and the distension continued about fifteen minutes, though not uninterruptedly, for an urgent desire to make water having come on

five minutes after its introduction, it was necessary to permit the escape of the air that the urine might flow by the side of the collapsed instrument.

18th day. There was rather more irritation than usual after the last visit, but this I attribute to a disordered state of the bowels, of which the patient has complained for some days past. The urine flows in a tolerably full stream, but is much oftener évacuated than is natural. I introduced the same dilator to-day as on last occasion, but not with the same ease to the patient, the canal being in an irritable state, and for this reason I did not produce greater distension; — I prescribed for the disorder of the bowels.

21st day. The irritation has now entirely ceased. I passed the No. 12 dilator, kept it distending the stricture about a quarter of an hour, and before extracting it, I could nearly inflate it to the full extent without causing much uneasiness. This second inflation would indeed have been necessary at any rate, as from the looseness of the stop-cock employed, much of the first injected air had escaped.

22d day. I passed a No. 14 dilator, and after it had remained about ten minutes causing considerable pressure, I rapidly inflated it to the greatest degree, immediately afterwards allowing the piston of the syringe to recoil. The

distensible tube was a little soiled with blood upon being withdrawn.\*

25th day. The patient expressed great satisfaction in observing that the urine now flowed in a larger stream than it had for years. In order to examine the neck of the bladder and prostate gland surrounding it, I passed a No. 11 cylindrical sound into the bladder without meeting with obstruction or other sign of disease beyond the stricture. As there was much tenderness about the stricture, I declined any farther measures to-day.

27th day. I introduced the No. 14 dilator again to-day, and inflated it fully †. There was considerable uneasiness experienced, which was probably as much owing to the tender state of the parts as to the degree of distension made.

28th, 30th, and 31st days. On these days I made use of the same dilator, the No. 14, each time distending it fully with water. On the 31st day, (twenty days after the first application,) it can be thus distended with scarcely any disagreeable sensation. The frequency of urinating has by this time subsided, but still a slight gleet discharge oozes from the urethra. As

\* No. 14 of my scale is equal to No. 16 of many of the shops, and about three sizes larger than any solid instrument which the orifice of the urethra, in this case, would have easily admitted.

† In the last stages of the cure, the surgeon must attend particularly to the distance of the stricture, that he may hit it.

the stricture was now, however, dilated to the full extent of the urethra, or, in other words, removed, he was desirous to take leave, being required abroad on a mercantile affair.

I saw a friend of this gentleman some months afterwards, who informed me that his general constitution was greatly invigorated, and that he had not since his departure complained of any affection of his urinary organs.

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## CASE II.

*Hard unyielding Stricture, incurable by the gentle action of the Bougie, treated successfully by the Dilator.*

A GENTLEMAN of middle age, and much impaired constitution, newly arrived from India, complains of being obliged to make water every two or three hours, with frequent difficulty in doing so,—of a gleety discharge from the urethra, which is occasionally very considerable,—of uneasiness and itching about the perinæum. The stream of urine is small and twisted. He has had these symptoms during the greater part of the last six years. He had a severe and long-continued gonorrhœa three years before their appearance.

Some time after the commencement of this disorder, on sounding the urethra, an obstruction was discovered nearly two-thirds down ; for the removal of which small bougies were employed every, other day for upwards of three months ; but this treatment producing little advantage, the patient was then prevailed upon to submit to the forcible introduction of a pretty large silver catheter. It was passed through the stricture, but was followed by the loss of a large quantity of blood, and much irritation, which, spreading to the bladder, caused a distressing frequency of urining for several days. At the end of this period, however, when these immediate effects of the forcing had ceased, he found himself relieved in every respect.

Had the dilatation been carried on to a farther extent he might probably have experienced lasting benefit ; but as the surgeon did not press the continuance of any farther curative measures at this time, and the patient from his present relief was unwilling to submit to them, the use of instruments was totally abandoned. In about eighteen months from this time the difficulty of urining recommenced, but as circumstances had separated the patient from his former medical attendant, he did not apply to another for advice till after some months of suffering, and when the disease had become alarming. Many fruitless attempts were now made

to introduce a small instrument into the bladder, which the surgeon in attendance attributed both to the narrowness of the stricture, and to an irregularity, or pouch, caused by the previous forcing, into which the instrument was apt to go, even after it was again found practicable to pass it beyond the stricture. It was then discovered that another stricture existed a little farther on in the canal, which added to the difficulty of passing the bougie into the bladder. Ever since then only small catgut bougies have been occasionally passed, and always with much difficulty, and they have produced little or no dilatation. At last, despairing of relief by the common means, and his health being generally impaired, he was persuaded by his friends to return to England, and to have caustic, or other more effectual measures applied for his relief. He suffered much from the protracted irritation of the disease, and he was much distressed by the necessity of forcing through the bougie himself, while on board ship, to prevent the increase of the stricture. He has been several times troubled with retention of urine, but the warm bath and passing the bougie always relieved him.

I at first attempted to pass a small wax cloth bougie through the strictures, but it was stopped by the first, and so bent by pushing it onwards, that I was obliged to extract it. I then, at the



patient's suggestion, introduced such an elastic bougie (No. 4) as he had commonly employed, and by turning it about like a gimlet, (a practice he had often followed himself, so hard and insensible had the strictures become,) I at last succeeded in passing it beyond both obstructions quite into the bladder. As it was then tightly grasped by the strictures, it could not be easily extracted without a similar motion; it was soiled with blood. I introduced immediately afterwards a whalebone-pointed (No. 8) dilator, and by some management succeeded at last in passing it within the first obstruction. I distended it suddenly with water to a considerable extent, (the distensible bag was not of the strongest silk,) but he did not complain of any uneasiness. After keeping up this pressure for a few minutes, I extracted the dilator.

3d day.—Little difference since last report, except that, for some time after the application, he had rather more difficulty in urining than usual. I passed a No. 8 dilator of the strongest material, which still entered the first stricture with some difficulty, and distended it with all the force of the thumb. He experienced, he said, a strong feeling of distension, but after the "painful boring" he had been so long accustomed to, he thought nothing of it. I did not continue this distension, but emptying the distensible tube, advanced it to the second stric-

ture, which it passed with ease. This I dilated in the same manner as I had the first, and then withdrew the instrument altogether. A few drops of blood followed it.\*

5th day. He had a sense of coldness alternating with flushings of heat, for about an hour after he last left me. He now makes water in a tolerably large stream, and since yesterday morning without any scalding. I passed a No. 7 elastic bougie into the bladder, and on extracting it there was no opposition from the urethra grasping it as formerly. There being a considerable tenderness about the stricture, I deferred till to-morrow using the dilator. The gleet discharge has considerably increased within these few days past.

7th day. He had a return of the feverish disposition which he had formerly experienced yesterday afternoon, and a scabby eruption has appeared about his mouth. The urine continues to flow very freely and without uneasiness. I passed a No. 11 dilator, having a short strong distensible tube, through both strictures as far

\* The first time a bougie or dilator is passed along a tender urethra, the patient may express alarm on seeing it sometimes a little soiled with blood, but this happens without any violence, from so vascular a membrane as the lining of the urethra then is, and is scarcely of greater importance than the bleeding from the gums produced by the use of the tooth-brush.

as the neck of the bladder ; and, after distending it, slowly extracted it till opposed by the further stricture, into which I drew the again collapsed tube, and then renewed the pressure. The first stricture was treated in the same manner.

9th day. Except that there have been no febrile symptoms, the circumstances of the case are as on last visit. I passed the same dilator, and in the same manner, and was able to extract it distended without meeting with much obstruction at the strictures.

11th day. I dilated both strictures at once with a No. 14 dilator fully distended. He had often, he said, experienced more pain from the passing of the elastic bougie than on this occasion.

12th day. Having required to walk a good deal after the last application of the instrument, some irritation of the urethra was induced, which even now renders the introduction of instruments uneasy. I accordingly declined meddling with the stricture.

13th day. I renewed the distension by the No. 14 dilator in the seat of both strictures, and from the sensation produced I am inclined to think that they had been fully dilated to this extent by the former application.

17th day. I have applied the No. 14 dilator

three times since last report, continuing the pressure for some minutes, and each successive application, producing less uneasiness.

When this dilator is distended in the fore-part of the urethra it gives rather more uneasiness than at the stricture, which, as the fore-part is in a perfectly healthy state, proves that the lately contracted parts are at least dilated to the extent of the average size of the urethra. As the whole of the morbid symptoms, excepting the gleet, had now disappeared, he took his leave, with directions to use once or twice a-week, for some time, a No. 12 metallic bougie, and to return to have the parts still farther dilated, should there be any symptoms of relapse. As I have not since heard from him, though several months have elapsed, I have reason to think that farther dilatation will prove unnecessary.

As the common action of the bougie was found inefficient in the above case, the alternatives were, *forcing* a bougie or sound through the stricture, destroying them with caustic, or widening the passage, by cutting down upon it from the perinæum. He had suffered too much before to submit again to forcible dilatation, when the strictures had probably become still more unyielding, and the widening the passage by the knife is a practice now never adopted

where it is possible to introduce an instrument through the obstruction. Had caustic been applied, supposing the most favourable progress of the cure, and an exemption from every accident so frequently arising from this ungovernable remedy, the cure would have probably required, at a much greater expence of ease, a very much longer period. Instead of remaining quietly at home, a restraint which this plan of cure, by caustic, commonly exacts, the subject of the above case continued his usual pursuits with slight restriction.

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### CASE III.

*Common Case of Stricture treated by the quick  
Action of the Dilator.*

A YOUNG man applied to me for the cure of a gleet and some difficulty and pain in making urine, which he had to do more frequently than usual. These symptoms had existed for about a year, and he attributed them to an obstinate gonorrhœa he was affected with two years before, and for which he had taken large quantities of cubebs. On examining his urethra I discovered a stricture at the usual seat of six inches from the orifice, through which a No. 7 bougie could,

with difficulty pass. It being the first time in his life that an instrument was introduced, he experienced considerable uneasiness, and a sensation of sickness at stomach, and requested that no farther measures might be used that day.

On the third day I introduced a No. 11 dilator, and after continuing the dilatation by it for some time, finding that he bore it well, I suddenly distended the instrument to its full extent. As the pain produced was momentary, he did not appear to care for it.

Three days after, he told me that the stream of urine was much enlarged. The scalding on urining was very considerable during the remaining part of the day on which I had produced the dilatation. I now passed a No. 14 dilator, and at once dilated it to the full extent.

On the third occasion, and tenth day of the cure, I retracted a No. 11 dilator sound\* through the stricture with great ease; I then applied the No. 14 dilator, and kept up the pressure for some minutes.

Five days afterwards I repeated the same measures. The parts remained perfectly dilated.

\* This is a dilator with a very short distensible tube, useful in examining the urethra. When introduced collapsed to the neck of the bladder, and then distended, and in this state withdrawn, it ascertains the diameter of the stricture with more ease to the patient than a large bougie can, as there is little friction, from the small extent of the bulb, and the natural action of the canal is to push it forwards.

I passed the same No. 14 dilator three times afterwards with a week's interval between the several applications, by which time the gleet and other symptoms had disappeared. As the patient assured me he would much rather have the same process of cure repeated, should the stricture return, than be at the trouble of occasionally using a bougie by way of precaution against a relapse, I did not urge it, and four months afterwards he called upon me to say, that in his case the precaution would have been unnecessary, for as yet, at least, he had experienced no return of his disease.

Although it answered very well in the above instance to leave off the use of instruments, almost immediately upon the stricture being fully dilated, it is not the practice to be generally followed. A gentleman whom I attended for stricture of the urethra, left me rather abruptly after the stricture was fully dilated, and before I had explained to him the propriety of only gradually laying aside the instrument. So soon as a fortnight afterwards he returned to inform me that the difficulty of urining was nearly as great as ever, and the stream of urine as small. I notwithstanding passed a wide dilator sound beyond the seat of stricture, and after distending it, withdrew it almost without a feeling of opposition. This convinced the patient that

the present obstruction was of a very yielding and temporary nature ; and, after full distension had been repeated once a week for four or five times, while attention was paid to his general health, the obstruction and tenderness of the urethra had completely disappeared. It is certain that many instances of early relapse are merely temporary obstruction from that inflammatory fulness in the part, which may succeed to the measures that have been used for dilatation ; but as this may become permanent, the common practice of but gradually leaving off the use of instruments, is not only beneficial in removing the diseased state more quickly than might happen if it were left to the efforts of nature, but perhaps also in preventing its becoming a new permanent stricture. When, notwithstanding that a stricture has been dilated to the common size of the canal, it returns after some months have elapsed, I should then be inclined to treat it by carrying the dilatation to a still greater extent ; and thus I have sometimes opened the part by a gradual action nearly to half an inch, without exciting unusual irritation. I am of opinion that this will, in almost every case, be sufficient to effect a permanent cure ; but, as relapse may happen after many years, the comparatively recent origin of the practice with the dilator cannot as yet have afforded sufficient practical evidence of this.



The above case, which is not uncommon, forms a striking contrast with the treatment by other measures, whether we regard the time required, or the suffering to the patient. The plan of cure by keeping the catheter in the urethra, very common in France, and which, though painful, and most inconvenient, is there thought to be more expeditious than interrupted applications, requires, according to Richerand, “ *trois, six, neuf mois, et même une année, pour obtenir une dilatation convenable.*”

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#### CASE IV.

*Stricture, occupying considerable extent of the Canal, successfully treated by the Dilator and Catheter.*

A MIDDLE-AGED man was affected with all the usual symptoms of stricture to a severe degree. His general health had suffered much from the affection of the urinary organs, which had continued for five years. He had had gonorrhœa frequently in his youth, and he thought the last had been treated unskilfully by a very strong zinc injection. He had once a bougie passed into the urethra, about four years before he applied to me, but it produced so much irritation and fever, that he had not since had resolution to submit to the repetition, which now, however,

had become indispensable. For irritation of the bladder was apt to arise from the slightest irregularity of living, and gave him great distress by the incontinence of urine that followed. And the desire to make water, on other occasions, was commonly preceded by a painful sensation of heat about the perinæum, which was again immediately relieved by emptying the bladder.

I passed a small bougie through an obstruction, about three inches from the orifice of the urethra, as far as six inches and a half, but beyond that I did not get an instrument till after several other attempts, on different visits, sometimes made with the elastic bougie, sometimes with the steel sound. In the meantime measures were used to open the first stricture: which proved very obstinate, for after six applications of a dilator, so used as to make gradual and considerable distension, there appeared little progress made; the urine came indeed more freely from the urethra immediately after each application, but the obstruction very soon recurred. Upon examining it with a urethra sound, I discovered that it occupied about an inch of the canal. The farther stricture did not, on every occasion, admit the instrument to pass, until I was able to introduce a No. 8 dilator, by which I made considerable distension of the part; and by three other applications of larger instruments, with four or five days interval, I

succeeded in completely opening this stricture. This dilatation of it, though productive of considerable irritation at the time, which the nature of the patient's avocations was by no means suited to allay, as he was a millwright, and often exposed to the cold, in the beginning of winter, eventually reduced the distressing frequency of making water; and thus admitted of the dilator remaining for a greater length of time, within the first stricture, which would as yet, five weeks after the commencement of the treatment, only allow a No. 8 bougie to pass through it. Matters being in this state, I dilated the first stricture at bedtime to three-tenths of an inch diameter, by a strong continued-action of the dilator, and immediately, on taking it out, introduced an elastic catheter, nearly of the same size, which remained in the urethra during the night. Next day, after its extraction, there was some irritability of the canal, and once or twice the patient had occasion to pass a soft bougie down to the part before the urine would flow. As the patient was possessed of great manual dexterity, I now put the instruments into his own hands, and he continued applying them every other night, with such success, in the same manner, the urethra getting more and more accustomed to the presence of the catheter, that, before three weeks had elapsed, I could distend the No. 14

dilator within the stricture without causing much uneasiness. I did so four or five times afterwards, and then desired him to pass a bougie, occasionally, for a month or two. Before this time every symptom was removed, with the exception of a trifling discharge from the urethra, which would probably remain while he continued the use of the instrument, and of frequent nocturnal seminal emissions, arising probably from a similar cause. The urethra had become so insensible, that he might have almost worn the elastic catheter during the day, had it been esteemed necessary. He called upon me the other day, after an interval of two years, to consult me about another complaint, and his urethra remains quite well.

In the above history we have an instance of a long stricture requiring repeated and continued distension to effect its removal. In the case which follows, this continued action, from the state of irritability, was not submitted to, and accordingly only a periodical relief was afforded. Such cases, which are fortunately very rare, are frequently the consequences of former ineffectual or bad treatment.

## CASE V.

*Long Stricture, from a thickening or Tumour of the Urethra, periodically relieved by the Dilator.*

A MEDICAL gentleman visited me in order to have the dilator applied to a very obstinate obstruction about the middle of the urethra, which had resisted all the other measures that are employed for the removal of stricture. He ascribed its singular obstinacy to caustic having been applied too freely in the first instance, which he supposed had hardened and lengthened it, by exciting inflammation about the original contraction. An instrument of considerable size could pass through it, but this required to be used every second or third day, to prevent the contraction increasing, and was productive of much irritation. He was subject to occasional spasms of the urethra, about the stricture, causing temporary complete retention of urine, and this especially during the day on which he passed the instrument. He could not endure the presence of the instrument above a few minutes in the canal, which prevented his wearing an elastic catheter, to keep up a pressure on the part, as

had been recommended to him. He was therefore desirous to try the effect of momentary dilatation by the new instrument. I passed a No. 12 strong dilator into the stricture, and having a little brass check on the piston-rod of the syringe to point out the full degree of distension of the instrument, I, with one stroke, made this degree of distension. A few drops of blood oozed from the orifice of the urethra after the extraction of the dilator. The pain of distension being instantaneous, he declared it much more supportable than that caused by passing the elastic bougie through the part, and which last, instead of being immediately at an end, usually continued as a sense of irritation and heat, for upwards of an hour.

About a week afterwards he again called upon me, stating that, although the obstruction was again returned nearly to its original degree, the relief he had experienced altogether from the new instrument was much greater than that from the bougie. He had indeed been troubled on the day of application with a temporary retention of urine, but this he at once removed by his customary measure of passing a small elastic bougie through the obstruction\*. I now recom-

\* One of the most unpleasant, and frequently alarming symptoms, that attends the treatment of narrow irritable stricture by the common instruments, is the total retention of urine which occasionally occurs; the parts becoming gorged by the flow of blood.

mended the use of a full sized instrument, and applied a No. 14 dilator in the former manner. This gave relief for two weeks, during which time he had not occasion to pass an instrument. The dilatation was then repeated, and he afterwards applied it himself, with similar effects. He obtained so much relief by this measure, and with so little trouble, that he was unwilling to continue the pressure for some time each application, although the urethra became considerably less disposed to irritation.

into them, or being closed by spasm. Injury has often been done to the urethra in the attempt to pass the catheter in these cases. —Such spasm, of course, may also supervene to the strong application of the dilator, but the situation of the patient is then very different from what it is in the other case just alluded to; here there is really a considerable opening for the urine, although momentarily closed by the spasm, through which a catheter may be easily passed, if necessary; or relief may be quickly obtained by the warm bath or fomentation; but in the other case the opening is so narrow, that the smallest instrument can scarcely pass, even when the part is tranquil. What I have found to be a most useful means of relieving any spasm of the urethra, is to make warm water press against the contraction, by its own weight, for some time, from a catheter or tube inserted into the canal, the pressure being regulated by the height of the column of fluid. This is a modification of the means I have described in my treatise on stricture for facilitating the introduction of the catheter.

## CASE VI.

*Very irritable Stricture, treated by the quick  
Distension of the Dilator.*

I WAS sent for to see a man beyond the middle age, a shop-keeper in the city, labouring under a very severe affection of the urinary organs. He had had stricture of the urethra upwards of eight years. About four years before I saw him, an urinary abscess formed in the perinæum, which eventually caused a fistula, through which great part of the urine had escaped ever since. He had been occasionally using bougies for the greater part of this period, and the caustic had been three or four times applied for the purpose of reducing irritability. But for the last three weeks this was so great, that he could not endure any bougie to pass through the stricture of a size capable of dilating, and from the use of smaller ones he derived no other benefit than relief from retention of urine, with which he was occasionally troubled. He now made urine, mixed with a large quantity of mucus, every half hour, with much straining and pain, and his rest at night was disturbed by this, and by fever, which generally came on about bed-time. The stricture, he said, would



with difficulty allow a No. 5 bougie to pass through it, and the progress of this all along the further part of the urethra was productive of much pain. As he had tried every other means to relieve the irritation in vain, as opiates, leeches, fomentations, purgatives, I conceived the only thing that could prevent his sinking under this violent irritation, was fully and quickly to open the stricture, and thus to give free vent to the urine. Next day I passed a No. 10 dilator into the stricture, not without causing considerable pain, and finding that he could not endure its stay so as to make gradual dilatation, I distended it at once with the force of the thumb ; I then desired that the perinæum should be fomented, and prescribed an antimonial and opiate medicine to reduce the sensibility. This was in the morning ; and at night, on the same day, I found my patient in the following state : the urine came off in a larger stream, but with severe scalding, and the irritation was as great as ever. He had had a pretty smart paroxysm of fever three hours after the application. Nausea had been kept up by the medicine prescribed.

Next day, the irritation was sensibly diminished ; the urine came almost all through the natural channel, but still the distressing frequency of urining was present. He now discontinued taking the antimonial medicine. The day

afterwards, suspecting that the bladder did not empty itself completely, after he had made all the water he could, (nearly a wine-glass full,) I introduced a small elastic catheter quite into the bladder, and drew off upwards of five ounces of urine. After this he had no occasion to make water for two hours; but, as the irritation in the posterior urethra was still very considerable, the catheter was not again introduced till the evening.

Six days after the first application of the dilator, I repeated the distension with an instrument two sizes larger. As the parts were by this time much less irritable, I did not think it necessary to recommend any other measures after the distension than fomentation.

After the second application of the dilator there was considerable irritation of the urethra, and a return of the fever-fit, and the desire to make water became more frequent, but in less than two days he was the better for it in every respect. He could now pass a small catheter easily to draw off the urine completely, which he did three times a day, and the fever at night had completely disappeared.

I distended the stricture afterwards with a No. 14 dilator on three occasions, and he then passed a large bougie every third or fourth day for himself, but not into the bladder, as there was considerable tenderness, as yet, in the pros-

bladder. The only means that had at all relieved him was keeping a small elastic catheter in the bladder, but this for several weeks past, the urethra would not admit. The first time I applied a dilator there was but trifling pressure made by it, and there was very little change of the symptoms in consequence. An attack of gout coming on some days afterwards, the treatment of the stricture was suspended. The next time the dilator was used, one of No. 10 was fully distended in the urethra, but, as the patient insisted upon passing the instrument himself, and as the distensible tube was short, I had doubts whether he had placed it properly within the stricture. On the same evening his testicles began to be pained, and on the third day, when I visited him, they were both considerably swelled. Instead of fomentations, leeches, and nauseating remedies, the usual treatment of this affection, and which in all probability would have prevented its attaining any height, or would have materially shortened its duration, a lotion of camphorated spirits of wine had been prescribed by the patient's ordinary medical attendant. — As this gentleman thought proper never afterwards to request a repetition of my visits, I did not learn the issue of the case, although it is most likely, that if the dilator had really distended the stricture, he would experience eventual relief.

## CASE VII.

*Stricture, impassable to the ordinary Instruments of Dilatation, cured by the Dilator.*

THIS patient, a retired military man, had laboured under stricture of the urethra during six years. Three years after its commencement, he applied for professional assistance, finding that in using the bougie himself he made little progress, and caused much irritation. Two months after this, and while the surgeon was occasionally applying the bougie, the patient contracted a gonorrhœa, and the bougie was laid aside. The new disease had scarcely disappeared, when he was obliged to go abroad. On his return, a year afterwards, he again applied to his former surgeon, but no instrument, however small, could now be passed through the stricture. The last attempt at this occasioned a most painful and obstinate retention of urine, which so terrified the patient, that he abandoned every curative measure for a time. Becoming however subject to occasional strangury afterwards, he applied a third time to his surgeon, who, after two or three further unsuccessful trials to pass a small instrument, recommended the application of caustic. This the patient would by no means

submit to, being prejudiced against the remedy by the circumstance of a brother officer having died in consequence of a mortification in the perinæum, that had supervened to an application of caustic. Ever since, he had lived in a miserable, anxious state, occasionally attempting, but in vain, to pass a small catgut himself; yet, as he prudently avoided every other cause of irritation, he had not suffered much from obstruction to the urine. Understanding that I had proposed some new means for passing instruments in such cases, he came up from the country, and applied to me. Having accurately measured the distance of the stricture from the orifice of the collapsed penis, which was a little more than six inches and a half, I passed a small elastic bougie down to it, and after turning it about between my fingers for some time, while I pressed it gently against the obstruction, it advanced half an inch, but I could not make it proceed farther. The attempt with a small steel sound was equally unsuccessful. At his second visit, after new endeavours with the sound, with no more success than at first, I passed a small dilator, (the further end of the distensible tube of which was tied close to the extremity of the wire,) quite as far as the bougie had advanced, and then dilated it suddenly. From the sensation which the patient informed me was produced by the dilatation, I was pretty certain that part of

the obstruction was opened, and now extracting the dilator, I again introduced the small sound as before. It passed easily into the first part of the narrowing, and, to our great satisfaction, when the handle of the instrument was depressed, its beak surmounted the rest of the difficulty, and went smoothly on to the bladder.—After some days I passed a larger sound through the obstruction, for the purpose of dilating it, as it was as yet too narrow to admit a strong dilator, and at length I opened it, by the same means, to No. 6.

After this I applied the dilator, and by four repetitions of it, at each producing rapid distension, the parts were opened to their natural diameter. The prostate gland had become a little enlarged and tender from the long continuance of the obstruction in the urethra, so as to make the passage of a large instrument through the last portion of the urethra difficult.

This case illustrates how the desideratum in the treatment of those impassable strictures described in the last paragraph of the Introduction is supplied by the dilator.—For opening very narrow strictures to allow the introduction of the dilator, the sound which I have employed is not conical to the very point, but only commences to increase in size about two inches from the point,

that I may be sure it is within the stricture before I apply any pressure to the handle.

While upon the subject of impassable stricture, I shall give the outlines of a case where the complete impediment to the passage of the bougie did not depend on tortuosity, and was removed differently. Its instructive nature will excuse its insertion here, though not illustrative of the action of the dilator. — The patient had been affected for several years with a derangement in his urinary organs, but not experiencing much uneasiness, he had not applied for advice till he visited me. What induced him at last to do so, was the now extreme tenuity of the stream of urine. I found that there was considerable contraction of the orifice of the urethra, its diameter not being above No. 6, and I could not pass a small instrument beyond six inches. After attempting in vain to dilate the orifice permanently, I cut it, to facilitate the further necessary operations, and the patient kept a tubular tent constantly in it for four days. This opened it perfectly; and I now again endeavoured to pass the instrument beyond the farther stricture, but notwithstanding the employment of the auxiliary measure of the elastic cannula, described above, I could not succeed. For the elastic tube I then substituted a large cylindrical wax-cloth bougie, which I pressed mode-

rately against the stricture for a minute or two, every day, for nearly a week, generally attempting, after every such application, to pass a small instrument. On the last application of the large bougie it went suddenly through, and passed on to the bladder. The cure was completed in the ordinary way by the dilator, although febrile attacks of short duration, after some of the applications, protracted it considerably\*.

Some such mild plan will often succeed in opening stricture where it has been supposed that the only resource left was the application of caustic. An extraordinary instance of mismanagement, in such a case, was related to me lately by the gentleman who suffered from it. After two or three unsuccessful attempts had been made to pass a small bougie, caustic was used exclusively, and repeated once or twice a week

\* These paroxysms of fever are apt to attend irritation of the urethra, however induced, and often occur as symptoms before any remedial measures have been adopted. They do not appear to depend upon the degree of irritation present, so much as upon constitutional peculiarities. One of the most violent which I have ever seen, arose from merely passing a bougie through the urethra, in a case where frequent urining gave reason to suspect the existence of stricture. The fever, which continued nearly two hours, had the singular effect of completely allaying the disease of the bladder. The first attempts to pass an instrument through a narrow stricture are exceedingly apt to bring on this affection, in some constitutions, and still more certainly, the application of caustic. The only effect I have observed from it, is temporary weakness; but this may protract the cure.



for no less a period than two years, without passing through. At the end of this time he was persuaded by his friends to consult another surgeon, who, on the very first occasion passed a small catgut into the bladder, and dilated the stricture to a tolerably large size in six weeks.

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### CASE VIII.

*Diseased Prostate Gland complicated with  
Stricture, relieved by the Dilator.*

IN this case, the patient, who was upwards of sixty years of age, had been affected for twenty-eight months with frequency in urining, discharge from the urethra, and general irritability. For some time these symptoms had been partly relieved by passing a catheter, several times a-day, into the bladder, for the purpose of drawing off the urine, as it could not be all naturally evacuated. This operation he performed latterly for himself, but with considerable difficulty, as the small elastic catheter employed was much obstructed in its passage, both by the remains of a stricture at six inches and a half, which he had been troubled with during many years of his life, and farther on, by a changed state of the

prostate gland. The prostate gland had been examined from the rectum, and was found to be considerably enlarged.

I opened the stricture in the urethra to the proper degree by three continued applications of the dilator, during which the little sensibility of the parts admitted of considerable pressure. I next passed on the dilator to the prostate gland ; and, after five applications, the instrument continuing each time above an hour in the part, I could distend one there, of the average size of the urethra, without giving uneasiness. After this, a large catheter could be passed into the bladder without difficulty, and, as little irritation was now induced by it, the desire to make water became much less frequent, and the general health improved.

In the above case, which is one of the more ordinary instances of diseased prostate, besides the general swelling of the gland, the middle part probably projected into the bladder, and prevented, as a valve, the expulsion of the urine. When this modification of the disease has existed long there can be little hope entertained of a complete cure ; but in the beginning, the application of remedies, suited to reduce the irritation, may be successful. Nothing is more beneficial than regularly drawing off the urine by a flexible catheter, of such a size as will not

be apt to meet impediment in its passage. The dilator, therefore, as enabling the patient or surgeon to pass a large catheter easily for this purpose, will contribute greatly to the cure. I have not as yet, however, had much opportunity of seeing this particular affection of the gland in its first stages ; but, to several advanced cases, where the enlargement of the gland was unattended with great irritability, I have given relief, as in the above instance. Chronical obstructions to the urine may occur, too, from other affections of this part ; which, however, I conceive, may be generally removed by sufficient dilatation.

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## CASE IX.

### *Stricture of the Rectum cured by the Dilator.*

As gentle dilatation is the essential remedy for this disease, and is effectual in every case of simple stricture, where the irritability will allow of its use, the detail of the following case, which was the first in which the dilator was employed, will be sufficient to illustrate the practice.

We have already seen the injurious consequences of the friction of a bougie, and similar means, upon a tender stricture of the urethra ;

but in the disease now under consideration, from the different nature of the parts concerned; this friction and irritation is still more hurtful. Hence it has arisen, that many strictures of the rectum, from the imperfection of the means employed for dilating, have been left unremedied, or only such temporary relief has been given, as opiates, fomentations, &c., are capable of affording; and, even in those cured, much unnecessary pain and irritation has been produced. The dilator, which is introduced within the stricture, and again extracted, in a soft, pliable, collapsed state, which can act equally on any length of obstruction, which may carry the dilatation to any extent without ever at the same time keeping the frequently irritable sphincter of the gut distended, is obviously far preferable to any other means that has been employed for the same purpose. These advantages were immediately perceived by the profession, and many quickly availed themselves of them. I have only to regret that the difficulty, hitherto, of procuring the perfect instrument, has caused occasional disappointment, and prevented the universal adoption of the practice.

From the little additional irritation of the parts, caused by the use of the dilator, considerable relief may be given even in cases where the stricture depends on a malignant schirrous affection of the bowel. In the following case, treated

by the dilator, the bougie could not be employed with effect, owing to the great irritation caused by its friction.

Mr. ———, of a very delicate reduced habit, is affected with very frequent desire to go to stool, when he voids, with pain and straining, a small quantity of fœces, of a worm-like form, mixed generally with mucus. Distressing tenesmus follows every stool, and he has flatulency, frequent nausea, and want of appetite. He requires, in general, to take a powerful opiate to procure rest in the night, the constipating effects of which he prevents or removes by frequent doses of castor oil. His attention was first drawn to the disease of the rectum, about two years ago, by the appearance of hæmorrhoidal tumours at the verge of the anus, which were removed, but the surgeon in attendance deeming that they were not the only cause of the generally disordered state of health, examined the interior of the rectum, and discovered a stricture about three inches from the anus: this admitted a small bougie, yet almost as large as what the patient can now make use of, but the operation of passing it was always so painful, and was followed by so much irritation, that he was obliged soon afterwards to intermit it for weeks. He has since occasionally used it, though with very little success, to the present time. The gut, to the feeling, appears to be pretty regularly con-

stricted ; and, upon examining the canal, by means of the dilator sound, I found no other stricture within reach, and that this one, within three inches of the anus, occupied no great length of the passage.—I introduced a rectum dilator, measuring, when inflated, two-thirds of an inch in diameter, and, comparatively with the bougie he had formerly employed, it went very easily. I inflated it as much as the patient's feelings would allow of. After fifteen minutes, the air was allowed to escape, and the instrument was extracted.

On my third visit I substituted a dilator of the same size with that formerly used, but differing from it in having a portion of membranous tube between the metallic cannula and cock. This prevented the jerking of the instrument on the irritable part, while turning the cock, which, in some degree, occurred on the last occasion, and produced inconvenience. As there was little irritation from the last application of the dilator, I made the same degree of pressure to-day, but could not continue it for the same length of time in consequence of an urgent desire to go to stool, which came on.—A watery solution of opium was prescribed to be injected into the rectum.

5th, 9th, and 12th days. The dilatation was repeated on these days, but it proceeds very slowly, as the irritation of the parts prevents

any considerable degree of pressure. On the 9th day the dilator was retained in the passage for nearly half an hour. The parts now admit of more air being injected than at first, but there is as yet no sensible difference in the circumstances connected with the evacuation of the fæces. The instrument is retained in the parts by a T bandage.

20th day. The dilator has been used four times since last report, with increasing ease. The general health is not quite so disordered as formerly, nor does he experience the same degree of uneasiness on going to stool. In the beginning of the week two days elapsed without his having a motion, a circumstance very uncommon with him, and during this period the flatulency and swelling of the belly were particularly troublesome. This state was removed by a dose or two of castor oil, and his appetite has improved. I employed to-day, a dilator of nearly an inch in diameter.

28th day. As the dilatation proceeds it becomes more quickly effected, and with less suffering to the patient. The irritation of the rectum has now so far subsided, as to permit of the patient's introducing the dilator easily himself. He has employed the inch dilator, but cannot yet fully distend it. He can retain it in the rectum about an hour at bed-time. His bowels are get-

ting much more regular, and the fæces when consistent, are large in form.

39th day. The patient is now using an inch dilator, and can retain it for two hours at a time. He is in all respects better.

Six weeks after commencing the use of the dilator, I left off my attendance on this gentleman ; at which time, as the contraction was removed, and his bowels had greatly recovered their natural functions, he was about to leave town for one of the watering-places. He took an instrument with him for the purpose of using it occasionally, and as I have never again heard from him, I conclude that he is well.





## OF STONE IN THE BLADDER ;

*Being a Criticism on the present Methods of Operating ; an Account of new Securities against several of the Dangers of these ; the Description of a new Method of Injecting for the Solution of Stone, and the History of a Case of a common sized Stone extracted by means of the Dilator, without cutting the Bladder.*

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FROM the severe suffering of the patient labouring under Stone in the Bladder, and the remedy being an operation so painful and dangerous, that many wear out their lives in certain misery rather than submit to it, it has arisen, that no part of surgery has excited more attention than this, either in the medical profession, or out of it\*. No very important change in the treatment of this disease has now been made for upwards of a century ; and indeed it has appeared to be the opinion of modern surgeons, that the manner of operating practised by Cheselden about a century ago, and which has been called

\* The catalogue of authors who have written upon Stone, occupies in Ploucquet's *Literatura Medica*, no less than twenty-nine very closely printed quarto pages.

reducing it to a size that will pass. The substances which affect the composition of the urine with this view, are chiefly the different alkalies and acids, and water taken copiously.

## SECOND METHOD.

### *The Solution of Stone by Injection.*

When the solution of the stone is the object in view, it is a very circuitous way to send the solvent, as described in the last section, through the long path of the circulation, in which it may be doing injury to the constitution, and becoming itself inert, when a short and direct road is open for it to the bladder, by the urethra. The idea was accordingly seized with eagerness, of thus directly dissolving stones, when improving chemistry began to inform us of their varieties and chemical nature, and of the best adapted solvents. This interesting inquiry was especially prosecuted by Fourcroy, in France, who has left us the details of his experiments on stone, both in the body and out of it. He found that small uric acid calculi, a variety, constituting a large proportion of what occur, may be softened and dissolved by being kept for a few days in a watery solution of the pure fixed alkalies, so mild as to be swallowed; and that the stones, consisting of the earthy phosphates, which are

of very frequent occurrence, may be still more quickly dissolved by the nitric and muriatic acids, sufficiently diluted to be no sourer than lemonade, and hardly more acrid than the urine itself\*. Many chemists have ascertained the solubility of a great number of urinary calculi in a large proportion of common water, and the fact has been adduced as a motive to prosecute the inquiry as to the cure by injection. Dr. Darwin and others have recommended the patient's drinking largely of water, to soften and wash away the stone†. Henry, to whom we are indebted for an accurate account of the lithic calculi, expressed it as his opinion, that if the urine were deprived, by appropriate remedies, of its power of depositing new calculous matter, it might itself have the same effect as water in dissolving the lithic concretion‡. In the 5th volume of the "Edinburgh Medical Commentaries," there is a notice of the report of a traveller of credit, in Arabia, who stated the common and effectual cure for stone in that country, to be, the injection of an alkaline ley with opium into the bladder, by a gold catheter. Dr. Marcet, the latest English writer on this subject, mentions that, in a case of stone under his care, at St. Thomas's hospital, a lithontriptic injection,

\* "Système de Chymie," vol. x.    † "Zoonomia," vol. iii.

‡ "Dissertatio de Acido Urico," 1807.

consisting of twenty-three drops of muriatic acid in four ounces of water, was repeatedly used, and retained for upwards of an hour, without producing the least inconvenience\*. This is a quantity of acid, double of that which, in conducting some experiments on this subject, I found very rapidly to dissolve an earthy calculus immersed in it.

With all these circumstances, and many others that might be mentioned, promising so much success, it may seem extraordinary that the practice of injections has been totally relinquished. It is just mentioned by some late writers; but it appears, that the endeavours to improve the cutting operation have much diverted the attention of the medical world from the subject. The reasons of its disuse probably are, 1st, the exceedingly imperfect method of injecting the bladder, hitherto practised; 2dly, the difficulty that has existed of ascertaining the kind of calculus in the bladder, in order that the appropriate solvent may be applied.

The methods that have been in use for ascertaining the nature of calculi in the bladder, are, the examination of the urine, especially of its deposits or sediment, and the examination of a solvent injection after it has remained sometime in the bladder.—No characteristic quality has

\* See his "Treatise on Calculous Disorders," 1817.

been discovered in the urine that is secreted during the formation of certain stones, and in the cases of lithic or earthy calculi, unless the diathesis to the formation of the particular matter be at the time of examination very marked, no correct idea can be formed from the urine. Even should this disposition be very plain, as the substance deposited from the urine may be different from that constituting some of the layers of a compound calculus, the examination may lead to erroneous conclusions. The mixture of the urine with the injection, in the second plan mentioned, would prevent us forming a rational conjecture on the subject.

Now if the smallest particle of the stone could be procured, its chemical composition may with certainty be determined. With this view the following means may be adopted: When the stone comes to the orifice of the bladder, let an open-pointed catheter (having of course a ball-ended wire filling it during the introduction) be passed till it touch it, and by this a small circular saw, like that of the trephine, may then be introduced to grate off from the calculus, by a few turns, a sufficient quantity of dust for examination.

The method of injecting that has hitherto been employed, is merely to throw at once into the bladder, a large quantity of the solvent, which is

to be left there as long as the bladder will bear it, and to repeat this process according to the sensibility of the parts concerned. The remarkable defects of the plan are the following :—

1. The solvent cannot remain in contact with the stone, nearly in a state of purity, owing to the constant descent of urine from the kidneys, which dilutes it, and the salts of which combining with it, may render it inert.

2. It becomes necessary, therefore, to throw in a considerable quantity at once, which, farther augmented by the addition of the urine, quickly excites the bladder to contraction by bulk alone, independently of its chemical nature, so that it can be retained in contact with the calculus but for a short time.

3. To expedite this slow process of solution, and to save the trouble of the very frequent injections required, there is an inducement to use the solvent in too strong a state, and from this circumstance such irritation of the bladder follows, as to render the total suspension of the process necessary for considerable intervals. The consequence is, that the patient either tires of the tedious proceeding, and abandons it from the little benefit derived at so much expence of suffering, or the attempt may be rendered abortive with any degree of patience, from the stone being as much increased by new deposition in the

intervals between using the solvent, as it is diminished during its short applications.

Now as urinary calculus is precisely the same substance, whether it be yet in the living body, or extracted from it and in our chemical laboratories, and as in the latter case we can easily dissolve it by agents of such strength as may be injected with impunity into the bladder, it evidently follows, that, if these agents or solvents could be applied to stone in the bladder as advantageously as when out of it, precisely the same result would follow. The following contrivance, called the *double catheter*, seems to possess every property which can be conceived desirable in an apparatus for this purpose. It is one of the improvements in the treatment of urinary diseases, for which we are indebted to my brother, Dr. Neil Arnott; and independently of what its merit may prove to be in this application of it, it has been found of the greatest importance in the treatment of some other affections of the bladder, to be afterwards mentioned.

The double catheter may be made of metal, or of elastic gum. When of metal, it is formed by running a partition along a common catheter, so as to divide it into two channels, which open near its point, by distinct holes of the usual size. By one of these channels liquid may be passing into the bladder while it is again



escaping, mixed with the urine, by the other. When of elastic gum, it is formed by inserting a small catheter into a larger one, and using the first for the injection of the fluid, while the latter allows it again to run off. In either construction separate flexible tubes must be attached to the outer extremities of the divisions or catheters, as prolongations of these ; one, to connect the catheter with the reservoir from which the fluid is to enter by it, the other to carry off the waste fluid and urine to a fit receptacle \*. This apparatus has other obvious applications in affections of the bladder, besides that of dissolving stone. It is well adapted to relieve irritable bladder, in a great variety of cases in which it occurs, by allowing the acrid urine to run off immediately on descending from the kidneys, while any bland or medicated liquid may be kept circulating in the apparatus, and occupying the bladder in the desirable quantity instead of the urine. Again, it enables us to dilate a contracted bladder ; a fluid column of any height may be made to act upon the bladder for this purpose, by varying the altitude, in relation to the patient, of the reservoir and extremity of the waste pipe. We shall see presently of what importance these two applications of it may sometimes be, as preparatory to the cutting operations for stone.

\* For a particular description see the explanation of the Plate.

Of the utility of this apparatus for relieving irritable and contracted bladder, I have had ample experience; of the solution of stone by it, although its fitness from many considerations appears as obvious and certain, I have not as yet made the experiment in the living body. It may be thought that I should have delayed entering upon the subject, till I could adduce cases of stone treated in this manner; but, as I had to speak of the apparatus at any rate, it appeared to me better to give at once every idea of interest I had connected with it.

The double catheter will enable us to place the stone in an uninterrupted stream of its proper solvent, while, from the rapid flow, the solvent is scarcely affected by the mixture of the urine. As fresh solvent is every moment coming in contact with the stone, however weak it may be, it will still have an effect, and there will be therefore no temptation to risk irritating the bladder by employing a solvent too strong, which the necessity of so frequent injection by former methods urged to. Although many bladders would probably bear with the constant circulation of a sufficiently active solvent, it might not be convenient for every patient to submit to this uninterruptedly; in which case, if appropriate medicines were taken to prevent the farther deposition of calculous matter, the solution might still be rapidly completed by acting only

during the night. I have relieved irritable bladders by letting the circulation of warm water go on through the double catheter, during the sleep of the patient, and the solvent of stone may be made so weak, as to be used in the same way without giving inconvenience. A patient soon acquires the power of introducing or wearing a simple catheter without uneasiness, (as in cases of palsied bladder or diseased prostate,) and in substituting the double catheter, there is only the additional circumstance, of his requiring a convenient stand for the reservoir and receptacle, and to preserve the water or solvent of a proper temperature. In the old method of injection, a considerable quantity of the solvent was forced in at each time, thus distending the bladder, and soon exciting it to contraction; but with the double catheter, there need never be more than a few drachms of fluid in the bladder, so that the stimulus of distension will never occur, and the extent of bladder-surface in contact with the solvent will be exceedingly trifling compared with what it is in the other case. This last circumstance may be of such importance, when it is question of throwing into the bladder any fluid which is unnatural to it, as to make the difference between success and failure. We have seen that water alone is a weak solvent of many calculi, and if long used, might complete the solution; but at

any rate it may be frequently employed in turns with a stronger menstruum. The operation should always begin by using water only, that the irritation of the bladder, constantly present in stone, may be moderated by it, and that the parts may also become accustomed to the presence of an instrument. The time that may be required for the solution of stone by the double catheter, must of course depend on a variety of circumstances, such as the size and chemical composition of the stone, and the strength of solvent which particular bladders will bear with impunity. Were this mode of cure successful, and once established, patients would not hesitate as is the case of lithotomy, from the pain and danger of the operation, but would apply in the very beginning, when of course the stone being small, its solution might be effected so much the more speedily. It is not at all unlikely that stones of moderate size might be dissolved in less time than the usual period of strict confinement to bed after the operation of lithotomy, but the patient would have no difficulty in submitting to such gentle means of relief, even for a longer time than this, should it be required, and would not urge the employment of a stronger solvent, recollecting that—

*"Gutta cavat lapidem non vi sed sæpe cadendo."*

In conducting this process of dissolving uri-

nary calculi, the requisites on the part of the operator will be a minute practical acquaintance with the different species of calculi, and their appropriate solvents, and a familiarity with that part of mechanical philosophy, which regards the motion of fluids in tubes, that he may be able properly to use the apparatus\*.

There is yet another possible method of dissolving stone in the bladder, which would be much more speedy than the process just described, because a stronger solvent might be used without injuring the bladder; but, as an extraordinary nicety of apparatus is necessary, and an unusual degree of dexterity in the operator, and as there would be danger to the patient were either of these wanting, most persons would decline running the risk, if the former more

\* The importance to the medical practitioner of a familiar acquaintance with the general philosophy of matter, is at present by no means sufficiently appreciated in the profession. Many students never make it an object of particular attention; yet several of the most important phenomena of the living body, both in health and disease, are only perfectly intelligible to those possessing it, and the application of many remedies cannot be correctly made without it. The surgeon who is particularly successful in the treatment of luxations, fractures, and in operative matters generally, excels chiefly from his better acquaintance, both theoretical and practical, with certain principles of natural philosophy; and such a man is full of resources in emergencies, where another, not so instructed, could do nothing. We owe some valuable curative means to this department of science, and it is probably not yet exhausted.

simple plan be attended with the desired effect. I publish the idea, however, as one probably altogether new to the profession, and deserving farther investigation.

Through a large open-ended tube, or catheter, already introduced into the bladder, two long wires connected by a hinge at their points may be passed, which have been so prepared as that a certain length of them, on protruding from the end of the catheter, shall by elasticity open and form a circle. So far the apparatus nearly resembles the forceps, that was contrived by Hunter, for seizing substances in the urethra or bladder, with this difference, that the points of the diverging wires are here connected. These wires in expanding as described, may be made to open the mouth of a bag or pouch attached to them, which had been wrapped round them during their introduction, and an expert operator would not then find it difficult to catch and place the stone in such a bag. Were the bag so connected with the wires, as that they should be to it, what a purse-string is to a purse, it is evident, that by drawing the wires again into the catheter, the mouth of the bag would be pursed up, and perfectly closed upon the stone. Now suppose this bag to be of material capable of resisting the action of acids and alkalies, it follows that the strongest solvent may be immediately injected into it upon the stone, by a small tube

of gold or platinum connected with the bag.—The material of the bag which would be most likely to answer is a silk-cloth, covered to the necessary thickness with gold-leaf. The experiment was made by my Brother upon a stone, in a glass vessel, with such an apparatus, and perfectly succeeded. Were the bag sufficiently durable, it might of course remain in the bladder until the process were completed; but, as it might become necessary from various circumstances to withdraw it, this could be immediately done after washing out the solvent with water, by again pushing forward the wires that they may open the bag, (one corner of which is attached to the end of the tube,) allowing the stone to drop from it, and then withdrawing both the bag and wires into the catheter for final extraction.

I may mention the following circumstances as meriting attention from those making further inquiries into the subject. For the construction of the bag common silk-cloth will not answer, as, in consequence of its yielding or stretching when pulled diagonally, the gold-leaf fixed upon it would necessarily crack in many places, and the solvent would escape. The cloth for the purpose must therefore be prepared, either by introducing diagonal threads in its texture, or by placing two layers of very thin cloth upon each other diagonally, and then gilding them. To

prevent the chance of injury from the escape of any part of the solvent, it would be advisable not to use it very strong—to keep but a small quantity in the bag—and to have the bag surrounded in the bladder with some liquid capable of neutralizing the particular solvent, alkali for an acid, oil for an alkali. An operator about to try this process, would previously reduce the irritability of the bladder, by the double catheter fomentation, or by opium; and, to prevent pain, he would search for the stone in a distended bladder.

### THIRD METHOD.

#### *Removing Stone by Mechanical Attrition.*

A Colonel of Engineers, in the service of the East India Company, about 30 years ago, removed a stone from his bladder by files introduced through the urethra: the operation was very tedious, but it proves the possibility of the thing. Dr. Darwin described an apparatus, which he conjectured might be used with this intention; but, as he meant to break the stone into distinct portions, the immediate effect would be to increase the number of stones, leaving them too of an irregular form, and in both ways more likely to irritate the bladder, without the cer-



tainty of making any of the portions sufficiently minute to escape by the urethra.

Better instruments might be constructed than any which have as yet been proposed for the purpose, but so much manual dexterity is required, and the operation is so tedious, that, except in such cases as that of the individual just mentioned, who united in himself the requisite ingenuity and manual dexterity, it is scarcely probable that the thing will be again attempted.

#### FOURTH METHOD.

##### *Lithotomy.*

The bladder has been cut in every accessible part of it for the extraction of stone:—At its lower part, where it is near the perinæum; at its upper and fore part, above the pubis; and, at its back part, where it is contiguous to the rectum.

The first of these, the lower operation, has been performed in a variety of ways, but the modification of it, called the lateral operation, is the best, and that which has been almost universally practised for the last century. It has not only taken the preference of the different lower operations, but of others generally. The second

enumerated, which has been called the high operation, although the most simple of all, has been comparatively little performed, because of some objections for which proper remedies had not yet been discovered. The third method of reaching the bladder, *viz.* from the rectum, has very lately been tried in Italy, in a particular case; but, as it is objectionable on many accounts, it probably will be very seldom if ever again adopted. The comparative merits of the two former operations will be understood from the following considerations:—Should the solution of stone succeed, however, as described above, these will have interest only as applicable to cases where the solution, for some reason, cannot be tried. And in all cases requiring Lithotomy, I trust, that I have to point out means of very much lessening the pain and dangers of the different modes of operating.

The chief circumstances upon which the fatal terminations of Lithotomy depend, are the following:—

- First, Exhaustion of the powers of life from the pain of the operation.
- Second, Profuse hæmorrhage.
- Third, Violent inflammation.
- Fourth, Protracted irritation, from an unhealthy state of the wound.

Death rarely happens from the first cause : When it does, it is generally in constitutions of extraordinary irritability, and in cases where much time is occupied in the operation, as when the stone is not easily found by the forceps ; or when a large stone is violently extracted through a small opening.

The second circumstance, profuse hæmorrhage, is not so rare a cause of death. Besides, that the pudic artery (which is most to be dreaded,) may be cut in the lower operation, an oozing of blood from smaller arteries, has been fatal.

The third circumstance, violent inflammation, which is by far the most common occasion of death, may arise from various causes. The extent and situation of the wound in the parts necessarily divided ; as well as other accidental wounds of contiguous important viscera :—the violence done to the parts by bruising or laceration, while searching for and extracting the stone :—the action of the acrid urine on the new surface, as it escapes by the wound, and its insinuation and lodgement among the adjoining parts.

The fourth circumstance mentioned, the protracted irritation, is likely to occur in cases where the constitution is bad—where the prostate gland or bladder is diseased—where the rectum having been cut into, a passage remains from it

into the urethra or bladder—or where, after the operation, (more commonly after the high one,) the wound remains long open and becomes fistulous, solely from the action of the urine upon the parts, which indeed prevents the early cure in most of these cases.

I shall now speak of means not hitherto known, which seem capable of obviating the principal dangers of Lithotomy.—A great cause of mortality after the different operations is the escape of the urine by the wound. This has formed the great objection to the high operation; after which, as there is no depending opening, the irritating urine is more apt than in the lower, to insinuate itself and lodge among the neighbouring parts:—but in the lower operation too, it has often been either directly the cause of death by the consequences of this lodgement\*, or indirectly, by the surgeon's dread of this, inducing him to make with the knife, too small an opening into the bladder, from which, much pain, bruising, and laceration, must necessarily accompany the forcible extraction of the stone†.—In

\* This is supposed to have been the cause of most of the fatal terminations after Frère Jacques's operating, who is reported to have performed the almost incredible number of upwards of 5000 operations.—See Scarpa's "Memoir on the Cutting Gorget of Hawkins."

† The alleged reason used to be the danger of cutting the membranous part of the bladder, but this is dangerous only from the

all operations, the escape of the urine has increased the inflammation of the wound, by irritating the new surface, and has prevented its ready healing, both by this and by washing away the exuded coagulable lymph. Attempts had been made in the high operation to prevent the escape of the urine by the wound, by leaving a common catheter in the bladder, introduced by the urethra; but, as the urine could not flow by this, until it had risen in the bladder to a level with the highest part of the catheter, or unless the bladder contracted to expel it, it is evident, that it would as readily ooze through the wound as pass by the catheter, and therefore this was no security. The high operation is, at present, frequently performed by making an opening into the urethra in the perinæum, for the passage of the urine, in addition to that above the pubis, by which the stone is extracted, and a catheter is retained in the low opening; but even this painful expedient does

effects of the extravasated urine, which explains Hippocrates's celebrated aphorism, that wounds of the bladder are mortal. Many surgeons, however, in preferring a small opening, are influenced chiefly by there being then less danger of wounding the adjoining important parts.—This laceration, &c. was the common cause of death after Lithotomy by the apparatus major, and is probably so after the modern operations on the principle of saving the membranous part of the bladder.—See Mr. S. Cooper's paper in vol. viii. of the "Medico-Chirurgical Transactions."

not, it appears, answer the purpose completely, probably from the opening being still not sufficiently low, or from the point of the catheter occasionally passing into the wound beyond the bladder, or being drawn out of the bladder while the patient changes his posture. It has been proposed to make the lower opening into the bladder, where it lies on the rectum, instead of in the perinæum, but to this proposal there are objections equally strong, *viz.* the consequent inflammation, and the risk of a fistulous communication remaining between the bladder and rectum. Besides, in many of those cases where the high operation is the only one which can be performed, *viz.* where there is much disease of the prostate, such an opening cannot be made.—No attempt to prevent the urine passing by the wound is made after the lower operation.

Now a catheter constructed so as to act as a syphon, introduced by the urethra, will carry off every drop of urine by the natural outlet, as soon as it descends from the kidney, and instead of leaving a tendency in the urine to spread in the wound and adjoining parts, the action of the instrument may be made so strong as even to draw any secretion from the wound that may take place in it. It may be well here to remind the reader, that a syphon is a bent tube, of which, if one end is immersed in a vessel of water, and

the other allowed to hang on the outside, with its extremity lower than that within, as soon as it is filled with water, a stream will continue to pass through it, as long as any remains in contact with its inner opening. The sucking power of the syphon, to use the vulgar intelligible phrase, is proportioned to the difference of level between the external extremity and the surface of the fluid in which the instrument is immersed.

The *syphon catheter* requires to be longer than a common catheter, and instead of one opening in the point, which is the construction of the common elastic catheter, it should have several, to diminish the chance of obstruction from the bladder touching it; and an inch of its external extremity must be turned sharply up, that it may always remain full of urine, for, should the air get into it instead of liquid, it ceases to be a syphon, and acts only as a common catheter\*. It might also be a useful precaution, to tie a bit of gut upon the outer extremity of the syphon, which would constitute a valve, allowing the escape of the urine, but by its collapse preventing the access of air. The syphon catheter must be filled with water before it is introduced, or immediately after; and it may be made to act with any desired force in removing the urine, by raising or lowering the external

\* Fig. 6, in the Plate.

extremity. To prevent the possibility of its being drawn out of the bladder, it may be well to pass something through it, which, on projecting from its inner open extremity, will expand in the manner of the urethra spring-forceps, and act as a button to keep it in its place\*. In the lower operation, any risk of the catheter getting within the lateral wound of the prostate gland, may be certainly obviated, by using a catheter so constructed, with a spring, or otherwise, as that its end may constantly bear against the opposite sound side. It will be proper, likewise, in order to obviate unpleasant irritation from the presence of the catheter in the urethra, to accustom the parts to it before the operation.

It is obvious that the use of the syphon catheter while it removes such dangers as proceed

\* See Plate, fig. 7. Many deaths have happened from the catheter slipping from the bladder after the operation of puncturing, for want of a simple contrivance of this kind to secure it.

I find a proposal of the forceps alluded to, for the extraction of stones from the urethra, of which Hunter has been esteemed the first inventor, in the Rev. Dr. Hales's "Statical Essays," published a hundred years ago, which has just fallen into my hands. A similar instrument, however, was described before Hales, by the German surgeon, Scultetus, in his "Armamentarium Chirurgicum," tab. xiv. fig. 11. Dr. Hales, it appears, had also the idea of a double catheter for the solution of stone; but, as the chemical nature of calculi, and their solvents, were then little known, the matter seems to have rested with the proposer. Writings on chemistry of that date being in late times of very little interest, the suggestion appears to have been unknown to modern writers.



from the extravasation of the urine, in Lithotomy and in other wounds, will also facilitate the healing, by allowing the parts to be perfectly at rest.

In the high operation, after a means of preventing the urine escaping by the wound, the other great desideratum is, the being able to cut into the bladder readily, and without the risk of wounding the peritoneum. For this purpose the older surgeons used to distend the bladder with water, in order to raise it sufficiently above the pubis ; but this being often impossible from its being permanently contracted, it has been a common practice latterly, to introduce a staff by the opening in the perinæum or rectum already mentioned, by which the bladder is raised above the pubis, and presented to the operator. A common sound or staff introduced by the urethra in the usual manner, cannot be felt over the pubis, in many cases, and therefore is not a sufficient direction ; but a staff or strong catheter of the common form, may be made to contain in its curved part a sliding piece, that may be pushed out after its introduction, like the joint of a telescope ; the curve would thus be lengthened to nearly a semicircle, and of course the point might easily be felt above the pubis.

Very frequently in cases of stone, the bladder being always under irritation from the presence

of the foreign body, it resists the natural degree of distension by the urine, and is apt to become permanently contracted. Hence it was that, the great distension of the bladder usually made in the first method of operating in the high way, was by some accounted the most painful part of the operation; and from the inflammation and paralysis of this organ often induced by it, and even occasional rupture, it was also a very dangerous part. Elevating it by an instrument does not completely supply the desideratum, for the neighbouring parts are not then so completely removed from the place of incision as when the bladder is fully distended. The previous use of the double catheter will generally reduce the irritation from stone, and expand the bladder, and the then possible combination of the two securities, (for the bladder may remain distended when the long staff is introduced by the whole urethra,) will exceedingly diminish the danger of wounding the peritoneum.

The hazard of cutting the neighbouring important parts is likewise the second great defect of the lateral operation to be lessened. The particular parts in danger depends chiefly either upon the direction of the cutting-edge in making the incision, or upon the kind of cutting-instrument employed and the degree of fulness of the bladder at the time of the operation. It is

objected to directing the knife at all downwards, that the seminal ducts and rectum are then endangered; in any other way, the pudic artery. The two former parts can only be completely avoided by turning the sharp edge in another direction. The artery may be then avoided, either by pushing the bladder to the right side, that is, away from it, with the staff, or what may answer perhaps better, by using an instrument, consisting of a narrow blade, cutting outwardly, and a perpendicular plate (at right angles with the former,) to stretch out the upper and lower sides of the wound during the incision, so as to make it appear a vertical instead of a horizontal cut. Among the infinite variety of instruments that have been proposed for cutting the bladder, none have been contrived with this most important view. Bromfield's round gorget, which was proposed on account of some other alleged superiority, has an advantage of the sort, but the principle in question having never been adverted to in it, his instrument was never generally adopted.—A modification of the Dilator, as in *fig. 3* of the plate, is better adapted to restrain hæmorrhage after Lithotomy, than the common means of pressure.

There is great hazard of wounding the fundus of a contracted bladder, and even the perito-

neum, which forms its outer coat, when the gorget is used. In operating with the knife, particularly in Cheselden's third and last method, this hazard is removed; but as the plan is objected to by many surgeons, the possibility of previously dilating the bladder by the double catheter, will be to such an acceptable expedient. A further advantage of this means, as preparatory to Lithotomy, will be perceived upon the reflection, that the risk of bruising or lacerating the bladder by drawing a stone through an opening made into it, is always less in proportion to its dilatability. Much dilatation is commonly required, for the wound made by a gorget of even an inch in breadth, cannot, without further dilatation, admit a stone to pass, the smaller diameter of which exceeds two-thirds of an inch, and this exclusive of the forceps which holds it.—In regulating the size of the wound, when the membranous part of the bladder is to be cut, regard ought to be had to the state of distention of the bladder at the time, and also to whether it be dilatable to the natural extent, for a very small opening in a contracted healthy bladder is equivalent, by being capable of greater dilatation, to a large wound in its distended state. The smaller extent of wound required, and the avoidance of the other dangers from cutting the prostate gland, in the operation which has been practised by Foubert and others,

who cut directly into the bladder beyond the gland, are, if the methods proposed of obviating the wounding of the pudic artery, and the extravasation of urine, be found to answer, strong arguments in its favour as compared with the present lateral operation.

With respect to the high and lateral operations, it may be remarked, that the high cannot be prudently practised where there is much *irremoveable* contraction of the bladder, nor conveniently in very corpulent patients; the low, where the stone is of such size as not to permit of its being extracted unbroken by the lower opening in the pelvis, without contusion of the soft parts, or where the prostate gland is much diseased. Regarding their respective claims to become the common operation, where the peculiarities mentioned do not exist, I am of opinion that, should the improvements of the high operation, just suggested, be found generally successful, it would certainly deserve the preference. This will be rendered evident by the following brief statement of the advantages of the high operation.

In the high operation, the only neighbouring important part at all likely to be wounded is the peritoneum. Means have been pointed out by which this accident may be better guarded against than formerly; and, although it should

be cut, as the urine may be now prevented from afterwards escaping by the wound, there will not be much danger. The wounding of the peritonæum, which has frequently happened without any bad consequence, has hitherto been often the fault of the operator, in performing the high operation where the peculiarity of the case made the lower the appropriate one.—In the lateral operation, on the other hand, arteries are more exposed to injury, and the hæmorrhage is more difficult to restrain; the seminal ducts and rectum are liable to be cut: the first accident often occasions sudden death—the second, may cause impotency—the third, aggravates the inflammation, and often occasions incurable fistulæ of the most disagreeable kind. The peritonæum has likewise been wounded through the fundus of the bladder.

It is not an easy matter to ascertain when the stone is of a size which cannot be easily extracted through the lower opening, nor when the prostate is so diseased as to render the lateral operation improper. The incurably contracted bladder, one of the objections to the high operation, is more readily discovered, as by the quantity of injection it will receive, or even by passing a sound into it.

A smaller opening into the bladder is sufficient for the extraction of stone above the pubis, because the membranous part of the bladder is

much more dilatable than the prostate gland ; and it is likely that the upper part of the bladder is also more dilatable than that immediately beside the prostate, as this may become indurated or diseased, from constantly supporting the stone : such a diseased state would also render a wound there more difficult to heal. Hence, above, there will be less inflammation, and a more speedy cure.

There are several other minor advantages, as—the simple nature of the operation, diminishing the danger of mistakes—the less pain from the whole wound being smaller, &c.—the stone is more easily grasped by the forceps,—encysted stones may be more readily extracted,—there is no necessity for the tying of the hands and feet together, so terrifying to the patient in the lower operation—there is not the cutting of the sphincter of the bladder, as in the lower operation, by which its power of retention may be destroyed.

The mortality from the two operations has, notwithstanding the more imperfect mode of performing the high operation than the low, probably been about equal. Cheselden, whose success in the lateral operation has always been mentioned with admiration, was quite as successful when he performed the high\* ; and we

\* He performed the high operation nine times and lost only one patient, who would have died soon at any rate, as he had mortal visceral disease.

are informed that a lithotomist of Paris, who makes this his common operation, is equally so\*.

#### FIFTH METHOD.

##### *The Removal of Stone by dilating the Urethra.*

Stones of considerable size are often expelled in this way by the mere efforts of nature, especially from the female bladder, the urethra in females being short, and not surrounded at its commencement, as in males, by the more unyielding prostate gland†. In imitation of this natural cure, the female urethra has been repeatedly dilated by instruments with success; but for the safe and extensive dilatation of the male urethra, no perfect means was till lately known. The attempts at this have had for object either to dilate the whole of the urethra, or only the part near the bladder, beyond an opening made into it from the perinæum. In the former way it is recorded, that the older Arabian surgeons extracted stones, the passage being simply inflated, or widened by inflating with the mouth a distensible cannula introduced

\* See the account of Dr. Souberbielle's operations in Carpué's "History of the High Operation," 1819.

† There is an instance recorded in the early part of the "Philosophical Transactions," by Dr. Molineux, of a woman voiding an oval stone of prodigious size, the smallest circumference measuring five inches and three-quarters.



into it, upon which the stone, after being put into the further extremity of the canal by the finger in the rectum, was drawn through by suction\*. These accounts, however, have in Europe been totally discredited, although circumstances, to be presently mentioned, will render it probable, that, absurd as some of the recorded particulars of the operation evidently are, there was really some method in use for extracting stones by mere dilatation.—The whole urethra has likewise been dilated for this purpose by a succession of bougies†. One principal objection to dilating the whole urethra is, that the length and curve of the canal prevent the easy introduction of a forceps to extract the stone; and, as opening the urethra from the perinæum is attended with no danger, this has generally formed a preliminary step to dilatation. In the operation called lithotomy by the apparatus major, which was the common cure of stone for several centuries, the dilatation was made by introducing through this opening, into the bladder, a dilator of steel blades, which were expanded forcibly to the required extent. This method was, in every instance, exceedingly painful, and the mortality from it was very great, in consequence of the violence done to the parts. Even amongst those who

\* Alpinus "De Medicina Ægyptiorum," vol. iii. 14.

† Le Dran's "Consultations," by Reid, p. 163.

survived the immediate effects of this violence many were rendered miserable, during the remainder of their lives, by incurable fistulæ and incontinence of urine.

The lateral operation, which took place of that by the apparatus major, differs from it, chiefly in the circumstance that, in the former, the prostate gland is divided by a knife, instead of being forcibly dilated or torn as in the latter. By it, therefore, the dangers from the peculiar violence done to the prostate gland, are to a great extent, avoided ; and although new dangers arise, they have been found less important than those from the sudden dilatation\*.

In the case, a detail of which follows, a new means was employed to dilate the entrance to the bladder, not liable to the objections made to all the expedients formerly used. It was a dilator filled with air, such as is represented in the Plate, *fig. 3*, introduced by an opening in the perinæum, which opening, by the time of the operation, had become callous. Dilatation, by such means, constitutes an operation for the removal certainly of small stones, and probably of

\* The lateral operation, however, as performed by many surgeons, is a very near approximation to that by the apparatus major. Bromfield, in the greater number of cases cut only the fore part of the prostate gland, leaving the base to be dilated or torn, a practice, which he informs us, was never followed by urinary fistula.

those of larger dimensions, safer and less painful than any which had been yet practised.

### CASE.

A Gentleman, beyond middle age, had been operated upon in the usual manner for stone in the bladder. Owing to the extreme fragility of one of several stones that existed, it broke in the extraction, and it was not until after three successive searchings, with an interval of about a week between each, that the bladder was supposed to be cleared of the fragments. Another unfortunate circumstance happened in the operation, which was, that the rectum was wounded. The wound of the rectum had continued in a fistulous state ever since, being a period of nine months, fæces occasionally passing by the urethra, and urine by the rectum. Some weeks after the operation, a severe irritation of the bladder arose, and the urine was sometimes expelled by painful spasmodic, contractions of the bladder, at other times it dribbled involuntarily off by the fistulous opening. Various expedients were resorted to for the cure of the fistula, but in vain; and, in this state, he came to London, where he was under the joint care of Mr. Astley Cooper, and Dr. Arnott. With a view to the cure of the fistulous communication between

the urethra and rectum, Mr. Cooper made an opening into the urethra, from the perinæum, close to the commencement of the fistula, and by this opening, he introduced a female catheter into the bladder, which remaining in the bladder, and, preventing its painful contractions, soon materially allayed the irritation. Upon then sounding the bladder, a stone was discovered; and, as it was likely to be small, but a short time having elapsed since Lithotomy had been performed, Mr. Cooper was willing to try the effect of the new dilator, in opening the passage for its removal. Two of these instruments were accordingly constructed for the purpose, under my direction. The distensible tube in both was about six inches in length; the diameter in one, somewhat more than half an inch, in the other nearly three fourths: and the distensible tube was tied upon a silver cannula, with both ends open, for the free exit of the urine. The smaller dilator being introduced in place of the female catheter, it was inflated as far as the patient's feelings would permit; and, as the sense of distension abated, I injected more air, generally after intervals of two hours. The larger instrument was substituted for the first, about twenty hours after its introduction, and eight hours after it had been dilated to its full extent. The passage was dilated to the size of the larger dilator in about six hours, and this instrument remained

in the part till the forceps was introduced. During the dilatation, the patient had an uneasy feeling of distension, but not amounting to what is usually termed pain : he was feverish, and his sleep, at night, was frequently interrupted ; but these circumstances may be as justly attributed to the anxiety he felt about the issue of a new operation on his own person, as to the irritation from the distension. The urine flowed constantly through the open tube.

In extracting the stone, Mr. Cooper employed the common forceps ; and, in all respects, except that there was no director used in its introduction, as in the usual lateral operation. The stone was a flattened oval, and of about the size of a walnut\*.

Two or three hours after the extraction of the stone, the bladder contracted, and expelled chiefly through the opening in the perinæum, about six ounces of urine. Some spasmodic pain accompanied the contraction ; and, as he had formerly experienced so much relief from the introduction of the short catheter, he expressed a wish that it might be reinserted, and the water let off by it till the irritation of the bladder had completely subsided. In four days this had taken place, and the patient now left his bed-chamber. On the ninth day after the operation, the wound in the

\* Fig. 4, in the Plate.

perinæum was completely healed, and he was able to take exercise abroad.

In this operation, an opening into the bladder of considerable size, was produced by dilatation, without the pain that accompanies lithotomy, or its danger. The difference between this gradual easy dilatation, as produced in the above case, and the violent painful dilatation which used to be effected by the apparatus major, and still is in the common lateral operation, when the gland has been but slightly cut, is sufficiently manifest; it bears a greater resemblance to the dilatation of the female urethra, which has been effected by gentian-root, sponge tent, and the gut filled with water, which was once employed by Bromfield; and of the male urethra, by the Arabian mode already adverted to. But the root, sponge, or gut could not, it is probable, exert sufficient power to open the prostate gland; neither is the pressure of the two former properly under controul; their passage to and fro would excite irritation; and the gut expanding from the heat and moisture, to an uncertain extent, would render it impossible to ascertain the degree of dilatation made. Of the Arabian mode of inflation, we know too little, to speak of its comparative merits.

It is impossible to form an idea to what extent the prostate gland may be thus gradually di-

lated, without injury ; but, should the operation be found well adapted for the extraction of stones of a moderate size, patients aware of this, and undeterred by the nature of the cure, would apply for relief in the early stage of the disease, so as to render the adoption of hazardous and more painful measures unnecessary. By attention to several circumstances, we can in general, form a tolerably correct idea whether the stone be of small size : but should it happen in any case, that the dilatation could not be carried to the sufficient extent, the stone may be broken or otherwise reduced in size, or the farther necessary passage may be made by cutting through the now thin and extended prostate gland to the membranous part of the bladder, which will then commonly yield with ease in the extraction of the stone to the required extent. Should the opposition to the extraction of the stone arise from the perinæal muscles, they could be divided by the knife after the dilatation of the prostate, as in the lateral operation.

Should the cure by solution fail, this method would appear the best adapted to those cases where the bladder is in a weak or paralytic state, as in them the wound in Lithotomy has been found very difficult or incapable of healing.

The keeping a small catheter introduced until the opening in the perinæum has become callous, will give considerable temporary relief

from the irritation of the bladder, and this practice was indeed frequently resorted to by the older surgeons, for the relief of those on whom it was deemed imprudent to perform lithotomy, or who were unwilling to submit to it; and the protraction of the operation by the gradual nature of the dilatation, will not be deemed an objection to it, by the patient, whose ease at the time, and future safety, depend on such protraction.

THE END.



